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THE INTERNATIONAL GEOPHYSICAL YEAR 1957-58

METEOROLOGISTS, geophysicists and scientists in allied fields discovered long ago that their sciences have to be reckoned and dealt with as truly 'international', for, the physical processes at work transcend the limits of 'nationalism'. It is therefore a matter for gratification that for the third time in a century, scientists from various disciplines and drawn from different countries, are to join, during 1957-58, in a critical examination of the ever-changing aspects of man's immediate physical environment. Such concerted endeavour on a limited scale, confined to Polar phenomena, had been arranged during the years 1882-83 and fifty years later, in 1932-33. But the forthcoming "International Geophysical Year" (IGY) is to witness a global endeavour of the leading scientists of the world to probe into the mysteries of our planet and its atmosphere, and obtain as comprehensive and complete a picture of the various physical processes at work as possible.

It may be of interest to mention here that the IGY has been engaging the attention for sometime past of various international scientific bodies such as the International Union of Scientific Radio, International Astronomical Union, International Union of Geodesy and Geophysics, International Geographical Union, World Meteorological Organisation, International Union of Pure and Applied Physics, etc.

The Bureau of the International Council of Scientific Unions (ICSU) has formed a Special Committee representing the various International Unions concerned which has been called the CSAGI (Comité Spécial de l'Année Géophysique Internationale) which met in Brussels during June 30-July 3, 1953, and elected Prof. Sydney Chapman as its President, Dr. L. V. Berkner as Vice-President and M. Nicolet as General Secretary. The CSAGI discussed the proposals for the various National Committees constituted for the IGY by differ-

ent countries and outlined the scope of the programme. These problems will again be reviewed in the light of the detailed proposals and programmes asked for from different co-operating countries and finalised when the Committee meets again in October 1954 immediately after the Tenth General Assembly of the UGGI which is being held there from the 14th to the 25th September 1954. It is expected that the CSAGI will be in a position to publish and distribute a volume outlining the world programme for the IGY-1957-58, early in 1955, giving the participating nations sufficient time to prepare themselves for executing their respective parts of the international programme.

The programme already outlined by CSAGI covers (i) Meteorology, (ii) Latitude and longitude determinations, (iii) Geo-magnetism, (iv) the Ionosphere, (v) Aurora and air-glow, (vi) Solar activity, (vii) Cosmic rays, (viii) Glaciology, and (ix) Oceanography. Large-scale observations embracing the above topics are to be recorded on three specified "World Days" each month, one near full moon and two near new moon and, in addition, on about two other special "World Days" each month to be declared about 3 weeks in advance, to coincide with predicted geophysical disturbances, solar eclipses, solar flares, and unusual meteor showers, etc.

In meteorology the main world problem to be investigated is that of the general circulation and the associated thermodynamics, particularly in the upper atmosphere, above the troposphere. Special attention is to be paid to the collection of complete information up to 30 km. height along the three meridians 10° E., 140° E. and 70° W. from pole to pole so as to elucidate the mass transfer of the atmosphere in the east-west direction. A dynamical study of the equatorial atmosphere is also expected to lead to an understanding of the mass transfer between the two hemispheres in relation to the general circulation.

The programme under geomagnetism includes the study of the changing morphology of magnetic storms and activity in relation to variations in auroral activity and associated changes in the electric currents in the upper air. The diurnal variation of the three magnetic elements in the zone containing the magnetic and geographic equator is also to be investigated. Rocket observations extending to high altitudes are expected to reveal the connections between geomagnetic changes and the electric currents associated with the aurora.

In the programme of auroral observations, air pilots and meteorologists are also to take part. It is also proposed to conduct synoptic observations on the air-glow at selected centres.

The latitude and longitude programme aims at improving the accuracy of time determination and to extend the knowledge of the irregularities in the earth's rotation, of relative displacements on the earth's surface and of time of propagation of radio waves.

The programme under solar activity includes observations of chromospheric flares and the continuous recording of wave frequencies emitted from the chromosphere and the corona. Rocket measurements of solar ultra-violet emission spectra and of the photochemical equilibrium of the ozone layer and above in our atmosphere are also planned. Limited programmes under glaciology and oceanography and scientific exploration of the Antarctic regions are also within the scope of the IGY.

The National Committee of India for the IGY under the Chairmanship of Dr. K. S. Krishnan, Director of the National Physical Laboratory, with representatives of the Meteorological Department, the Survey of India and other interested scientific institutions has drawn up a programme to be carried out in India in consonance with the ultimate World Programme of the CSAGI. India proposes to include an additional meridional cross-section in the northern hemisphere at 75° E. for the intensified study of the upper air over Asia, with half-a-dozen stations in India in the north to south direction taking part in the programme for studying upper winds, temperature and the ozone layer. Stations along the latitudes 23° N. and 15° N. for recording upper winds and temperatures on the World Days are also proposed. Radar observations on cloud development, measurement of the electric potential gradient and conductivity of the upper air, the radiation and thermal balance and the moisture balance at the earth's surface, besides rain measurements by selected ships at sea are also included under Meteorology for the IGY.

For the study of geomagnetic and associated phenomena in the upper air, it is proposed to have continuous records and absolute measurements at Alibag, Kodaikanal and Dehra Dun. There will be two additional stations north and south of Kodaikanal in South India to study the variations along the magnetic equator. The co-operation of the Physical Research Laboratory at Ahmedabad has been secured for recording the spectrum of the air-glow. Seven stations in India will record ionospheric data

both day and night. Intensified observations on the sun at Kodaikanal, cosmic ray time-variation studies at the Cosmic Ray Laboratories in India, latitude and longitude determinations, exploration of the Himalayan glaciers and Indian seas will all engage the attention of our scientists during the IGY.

It is hoped that the Government of India

will give every encouragement to scientists in India to play an adequate part in this great international endeavour, and that the Indian Universities and National Laboratories too will extend every co-operation to the National Committee in organising and executing this laudable programme.

A SIMPLE DEVICE FOR PARAFFIN EMBEDDING

PARAFFIN embedding under an electric bulb is preferred by many workers. It is not only easy to operate, but is inexpensive and can be installed anywhere near an electric point. It is found to be more accurate and easier to control than the common thermostatic ovens.

After working at it for nearly nine years I have been able to introduce certain modifications and features making it safer and easier to operate. About a pound of paraffin wax is 'smoked' in a 9" long beaker of about 2.5-3" diameter. The wax should fill up three-fourth of the container. An electric bulb of not more than 60 watt is suspended above the surface of the wax. A stronger bulb is liable to melt the whole mass of the wax, which is undesirable. It is best to have a 40 watt lamp just touching the surface of the wax. A small watchglass is kept on a piece of wire-mesh which is suspended by means of thin copper wires and adjusted about 1" below the surface of the melted wax, and about $\frac{1}{2}$ " above the solid surface. The distance may be adjusted by a little experience and is different in rooms of different temperatures. The material for embedding is put on the watchglass. As it is kept near the surface of the solid wax and in the molten medium, it remains near the melting

point, an essential requisite for proper embedding. Temperature in this region does not rise as the latent heat of melting of wax does not allow it to go high and because the amount of wax is quite big and the source of heat is above the surface and small as well as steady, the whole of the wax never melts. Thus the material may be left in the bath without any danger of getting 'cooked' or 'roasted'.

The wax container is placed in a small wooden box, whose inner lower half is painted black and the upper white. The bulb is suspended from the top of the box and a thermometer is introduced through a hole to record the temperature near the material. Another wooden box containing a bulb of 100-50 watt is used for keeping crucibles and wax-pans, etc., so that at the time of making blocks a ready supply of melted wax may be assured. The whole apparatus with the thermometer and the bulbs costs about Rs. 7 to 8. The working cost is very low and it does not require to be sent for repairs to any workshop. Another advantage is that for different types of wax with varying melting points, separate baths can be maintained.

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Pilani.

USE OF ANTI-MALARIALS

THE recommendations on the use of anti-malarial drugs prepared by the Malaria Sub-Committee of the Colonial Medical Research Committee have been published in a recent issue of the *British Medical Journal* (July 17, 1954).

The Committee observes that no single drug at present available is effective against all phases of the cycle of development of the malaria parasite; the preparation to be used for a particular purpose will be that active against the appropriate phase. The purposes for which anti-malarial drugs are used are:

(1) For causal prophylaxis or suppression (destruction of the parasite in the pre-erythrocytic phase or in the asexual erythrocytic phase). (2) For treatment of the overt malarial attack (destruction of the asexual parasites in the blood stream). (3) For radical cure of vivax and quartan malaria (destruction of the late exo-erythrocytic forms). (4) For prevention of transmission (destruction of the gametocytes in the peripheral circulation or interruption of sporogony in the mosquito). Details of the specific drugs to be used and the dosage are given in the article given above.

ON LINEAR STRUCTURES IN THE DIORITES AND ASSOCIATED ROCKS IN EASTERN SINGHBHUM, BIHAR

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IN the course of detailed petrogenetic studies between Kudada ($22^{\circ}42':86^{\circ}12'$) and Chandanpur ($22^{\circ}33':86^{\circ}19'$) in Eastern Singbhum, five distinct types of lineation were observed and mapped for the first time in the diorites and the associated granitic and metamorphic rocks of the area.

The area, which was geologically mapped by Dunn and Dey,¹ is covered largely by the 'Singbhum Granites' (chiefly leuco-granites, with granodioritic and dioritic patches) and a series of metamorphic rocks belonging to the Iron-ore series. The latter consist chiefly of phyllites, secondary quartzites and epidiorites and are older than the granitic rocks. All these rocks are cut across by the 'Newer dolerite' dykes.



FIG. 1. Puckering lineation in secondary quartzite at Binbura ($22^{\circ}40':86^{\circ}13'$).

The present author finds that excepting the Newer dolerites, all the rock-types in this area show a striking structural unity, as regards foliation, lineation and joints. Even where the junction between the granites and the diorites on the one hand, and the metamorphites on the other, cut across the regional strike, the foliation as well as lineation and joints have essentially the same disposition in the different rock-types. Foliation, lineation and joints in the granites, diorites, etc., are thus all of secondary origin.

Two types of foliation planes are present in these rocks: (i) a well-developed, steeply-dipping mineral-foliation (S_1), caused by a parallel arrangement of minerals, chiefly hornblende, quartz or mica; (ii) a set of close-

spaced joint planes (S_2), along which shearing accompanied by sericitisation, chloritisation or tremolitisation has taken place. In places, S_1 and S_2 make angles of $10-50^{\circ}$ between them. As indicated by the bending of parallelly arranged hornblende crystals close to the major shear-planes and minor displacement of mineral-foliation along some of the shear planes, S_2 must have originated at a later date than the mineral-foliation.

Linear structures are found both on the planes of mineral-foliation (S_1) and shear-foliation (S_2) and are of the following types:

Type 1. Mineral-lineation on S_1 , sub-parallel to its dip. This is due to a linear arrangement of hornblende and/or quartz along the plane of mineral-foliation and is best seen in the hornblende-bearing rocks. Sub-ellipsoidal fragments of epidiorite (about $\frac{3}{4}'' \times \frac{1}{2}'' \times \frac{1}{8}''$) with a linear arrangement sub-parallel to dip were noticed in an exposure of epidiorite-tuff near Gobradih ($22^{\circ}35':86^{\circ}16'$).

Type 2. Puckers on S_1 , sub-parallel to dip. These consist of small-scale folds (generally symmetrical) with crests spaced a few mm. apart, and are best seen in the secondary quartzites and the phyllites (Fig. 1). This type of lineation often accompanies lineation of Type 1. Usually the two are parallel to each other, but in places a small angle of $5-18^{\circ}$ is noticed. Large-scale warps on S_1 with axes parallel to those of the small-scale folds have caused local sharp variations of the foliation-strike from NNW-SSE to north-east, south-west or even east-west.

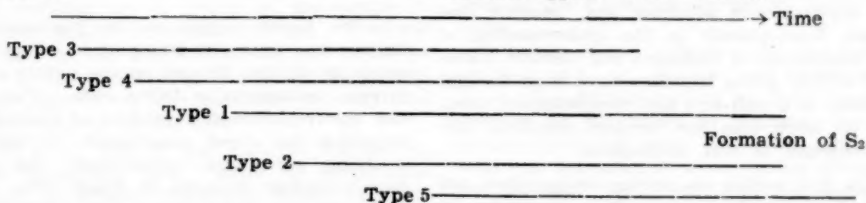
Type 3. Mineral-lineation on S_1 , sub-parallel to strike. This is similar to Type 1, but is seen only locally, such as near Matku ($22^{\circ}41':86^{\circ}13'30''$), south of Marchagora ($22^{\circ}41':86^{\circ}13'$) and west of Edalghutu ($22^{\circ}38'30':86^{\circ}16'$).

Type 4. Puckers on S_1 , sub-parallel to strike. They are similar to the puckers of Type 2, but are much more rare. Puckers of this type are not prominent and tend to be asymmetric. Co-existence of the two systems of puckers at approximately right angles to each other has given rise to 'ridge and basin' type of structures on the plane of foliation. The two sets of puckers intersect at $72-84^{\circ}$ on the plane of foliation.

Type 5. Mineral-lineation on S_2 , sub-parallel to dip. 'Streaks' of fine sericite or tremolite stringing out in lines on the shear-planes have given rise to a lineation on S_2 . Sometimes these are accompanied by striations resembling slickensides.

In addition to the above five types, intersection of S_1 and S_2 has locally given rise to a linear structure on S_1 ; some of the joint-planes show slickensiding; intersection of diagonal joints in sheared epidiorites near Dabanki ($22^\circ 38' : 86^\circ 16'$) has given rise to spectacular rodding.

forms interrupted lines; b-lineation in the present area is therefore believed to have developed slightly earlier than the a-lineation. The fact that the angle between a-lineation and b-lineation varies between 72° and 84° and is never exactly 90° , may have been due to a slight change in the direction of shear during the interval between the formation of b-lineation and that of a-lineation. The 'striation' type of lineation on S_2 is obviously a-lineation, with respect to movement along S_2 . The sequence of formation of the different types of lineation appear to be as follows:



Since the regional fold-axes trend NNW-SSE, while lineations of Types 1 and 2 show steep plunge either to the south-west or north-east, the author regards these two types of lineation as a-lineation, as defined by the movement pattern along S_1 . Because of their gentle plunges either to the NNW or SSE, lineations of Types 3 and 4 are to be regarded as b-lineation. Wherever the puckers of Types 2 and 4 intersect, the former occur in prominent continuous lines, while the latter type

A fuller account of these structures, including their petrogenetic implications, will be published elsewhere.

The author is grateful to Dr. S. N. Sen of Geology Department, Calcutta University, for his kind interest and helpful guidance during the progress of this work.

I. Dunn, J. A. and Dey, A. K., *Memoirs Geol. Surv. Ind.*, 1942, 69, Pt. 2.

LADY TATA MEMORIAL TRUST

THE Third Report on the working of the Lady Tata Memorial Trust, India Section, has been published, covering the years 1947-52. The Advisory Committee notes that compared to the preceding six-year period, there has been a steady increase in the number of applicants for the scholarships, the average being 27 and 39 per year respectively for the two periods, and that the academic qualifications of the applicants remain at a fairly high standard. There was also a much wider range of subjects offered for study. These included diseases of the blood, liver damage, diabetes, leprosy, tuberculosis, filariasis, carcinoma, arthritis; metabolic and nutritional studies with proteins, fats, minerals and several of the vitamins, synthesis of new anti-malarials, anti-

bacterials and other chemotherapeutics, and studies on natural products of therapeutic importance.

During the period under review, 29 scholarships were awarded, the number of students being 19. Nine scholars held the scholarships for 2 years and nine for 1 year. Extension for a third year was granted to one scholar.

On the whole, commendable progress was made by the scholars in their programmes of research and one result of the Lady Tata Memorial Awards has been the creation of a body of research workers in chemotherapy, pathology, clinical medicine and related subjects, some of whom at least will be a valuable permanent addition to the staff of Indian Universities and research institutions.

MECHANISM OF ENZYME ACTION*

THIS symposium on the mechanism of enzyme action is a logical extension of the previous symposia on phosphorus and copper metabolism held under the sponsorship of the McCollum-Pratt Institute of the Johns Hopkins University. The availability of isotopes and a number of purified enzymes has helped in elucidating the mechanism of a large number of enzyme catalysed reactions. The relation of protein configuration to its catalytic activity, the function of metal ions in forming chelates with substrate and enzyme, and recent developments in the understanding of the mechanism of hydrogen and electron transport and of group transfers have been brought together in a well-knit and comprehensive manner by more than one hundred scientists who participated in this symposium.

The first section on protein configuration and biological activity opens with a discussion by Kirkwood, on the forces operating between interacting protein molecules, with particular reference to those involved in the interaction of enzyme with protein substrate, or of antigen and antibody. The essential groups of chymotrypsin and the availability of these during the formation of the active enzyme from its zymogen are discussed by Herriot and by Neurath and co-workers, while the nature of the bonds involved in the maintenance of the native protein in the folded state and the mechanism of action of the various denaturing agents are considered at length by Kauzmann.

In the second section on the kinetics of enzyme action, Eyring discusses the relation between reaction rate and activation energy of enzyme-substrate complex. The role of enzyme-substrate complex as an intermediate in enzyme catalyzed reactions is further developed by Bull, with particular emphasis on the kinetic treatment of reactions involving activators and inhibitors. Fredenwald and Maengwyn-Davies have dealt with the simplification of the Michaelis-Menten theory, with a view to apply it to enzyme-catalysed reactions in general.

In the third section, the function of metal

ions in enzyme catalysis and the relation of chelation to catalysis are discussed by Calvin. The nature of the group in protein molecule responsible for the binding of the metal ion and the property of the metal protein complexes are discussed by Klotz. Further, the role of metal ion in forming co-ordination complexes with substrate and enzyme is illustrated by Smith and co-workers on the basis of their studies on two highly purified metal peptidases.

In the fourth section on the mechanism of electron and hydrogen transport is included an article by Britton Chance on the nature of the enzyme mechanism in living cells. The delicate spectrophotometric method of Chance has permitted the direct observation of reactions involving peroxidase, cytochromes and pyridine nucleotide enzymes in intact cells. Evidence for the direct transfer of hydrogen in reactions catalyzed by pyridine nucleotide dehydrogenases and for the steric specificity of such reactions is presented by Vennesland.

The final section contains papers on the function of enzymes in group transfer reactions. Racker has reviewed the formation of carbonyl and acyl complexes, discussing at length, the role of SH groups in acyl transfer. Uptodate information on the role of lipoic acid in the oxidative decarboxylation of keto acids is presented by Gunsalus. Further, the role of adenosine triphosphate in pantothenic acid synthesis and the applicability of the mechanism for polypeptide synthesis is discussed by Lipmann, and the mechanism of transglycosidation is discussed by Kalckar with reference to the role of the uridine containing co-enzymes in the formation of polysaccharides and nucleotides.

A lucid summary of the proceedings is given in the end by Bentley Glass. The book contains a number of important original contributions, and the incorporation of the discussions should be considered as a valuable feature. The participation of so many eminent enzymologists in this symposium lends a distinctive feature to this volume, and makes it quite an authoritative summary of the mechanism of enzyme action as it is understood today.

P. S. SARMA.

* *A Symposium on the Mechanism of Enzyme Action.* Edited by W. D. McElroy and Bentley Glass. (Johns Hopkins Press, Baltimore 18, Maryland), 1954. Pp xvi + 819. Price \$ 11.00.

OBITUARY

SIR LEWIS LEIGH FERMOR

WITH the passing away of Sir Lewis Leigh Fermor, Kt., O.B.E., D.Sc., A.R.S.M., F.R.S., F.G.S., M.I.M.M., F.N.I., F.A.S.B., one of the most illustrious geologists who have worked in this country and whose death took place on the 26th May, 1954, at his new home at Woking, Surrey, England, Indian geology has lost one of its best exponents and architects. He worked actively for over a third of a century in India and contributed substantially to the building up of geological knowledge on various aspects of Indian geology. The void created by the loss will be difficult to fill as, in this age of specialisation, it will be exceedingly difficult for any individual to cover such a vast field as he has done.

Sir L. L. Fermor was born in London, on 18th September, 1880. After his school education at Wilson's Grammar School at Camberwell, London, he won a scholarship and entered the Royal School of Mines for studies in metallurgy. He won the first place in the First Class in the Associateship Examination of the Royal School of Mines in metallurgy in 1901 and was awarded the Murchison Medal for his proficiency. Later he took the B.Sc. Degree of London University by research and in 1909, after a few years of service in the Geological Survey of India, the D.Sc. Degree of the same University for his work on the manganese ore deposits of India. He was elected a Fellow of the Royal Society of London in 1934 in recognition of his many contributions to Indian geology.

After taking his Degree in the Royal School of Mines, he applied for a post in the Geological Survey of India and was selected in 1902 by a committee which included a well-known name in Indian geology, namely, W. T. Blanford. Though the training of Fermor was essentially in metallurgy, it was broad enough in those days for him to take to geology as his profession and make a great success of it. Within eight years of his joining the service during which time he was associated with such well-known geologists as T. H. Holland, C. S. Middlemiss and H. H. Hayden, he was promoted to the grade of Superintendent. On various occasions between 1922 and 1930 he officiated as Director. On the retirement of Sir Edwin Pascoe in 1930 he was appointed permanent Director and continued in that post till 1935 when he retired on superannuation

and was knighted by the Government of India for his distinguished services.

During the period of his Directorship, Fermor had to face the drastic retrenchment which overtook the scientific services in India in the early thirties. He fought hard to save the Department from serious retrenchment, but though he did not succeed to his satisfaction, the Department was nevertheless left with a nucleus which could carry on some of the functions of the Geological Survey till better times came.

Fermor's major interest was in Archæan geology and in igneous and metamorphic rocks. The greater part of his field work was devoted to the study of Archæan rocks in various parts of India, largely in connection with his monumental work on the manganese ore deposits. At a later date he started the detailed mapping of parts of the Chhindwara District in the Central Provinces, but the only publication which resulted from this was part of his treatise on the Archæans of India. His work on the manganese ore bodies which occupied six or seven years of the earliest part of his career was published in a monograph of four parts which appeared in 1909 as Volume 37 of the *Memoirs of the Geological Survey of India*. This established him as an authority on the manganese ores of India, for this treatise still holds the field and it will take many years to revise it and bring it up-to-date. This and his subsequent papers bear testimony to the accuracy of his observations, and to the enormous pains he was capable of taking both in the field and in the laboratory. Numerous younger officers have had the opportunity of being associated with him in their work on Archæan geology and all will testify to his great industry, patience and meticulous care bestowed on observations. The study of the Deccan Traps led him to some important speculations concerning the interior of the earth and particularly about the existence of a layer of basic and ultra-basic rocks which might change their properties as a result of the conditions to which they are subjected at a depth of several miles from the surface.

Fermor's field studies included also the examination of the copper deposits of Singhbhum and of Sikkim; the chromite deposits of Singhbhum and Baluchistan; the coal deposits of the Korea and Bokaro coalfields; the iron ores

of Ratnagiri and Goa; the Deccan traps of Linga, Chhindwara District, C.P.; the basaltic lavas obtained by boring at Bhusawal and others. The results have been published in his papers contributed to the Department's publications and elsewhere. He also brought together the information on the mineral resources of the C.P. and of Bihar which were published in separate papers in 1919 and 1921.

During the First World War, Fermor's services were placed at the disposal of the Government of India where he acted as Mineral Adviser to the Ammunitions Board. He was also a representative of the Government of India in several International Meetings such as the International Geological Congress in Sweden in 1910, in Canada in 1913, in Spain in 1925 and in South Africa in 1929.

He played a very prominent part in the advancement of science in India. He was a Founder Member of the Mining and Geological Institute of India and was connected with it in various capacities including the Presidentship of the body in 1922. He was elected General President of the Indian Science Congress Association in 1933 when he delivered an address on problems of ore genesis in the Archæans of India. He was connected with the Himalayan Club as a Founder-Member; he was the Trustee of the Indian Museum between 1930 and 1935; a Member of the Governing Body of the Indian Research Fund Association from 1932 to 1936; President of the Governing Body of the Indian School of Mines from 1930 to 1935; President of the Asiatic Society of Bengal from 1933 to 1936.

He was also connected with scientific institutions abroad. The Geological Society of London, of which he was a Fellow, honoured him with the award of a Bigsby Medal in 1921 and elected him to its Vice-Presidentship in 1945 to 1947. He was President of the Bristol Naturalist Society in 1945 and of the Institution of Mining and Metallurgy, London, in 1951-52. He was a Member of the Society of Economic Geologists (U.S.A.) and an Associate Editor of the well known Journal, *Economic Geology* for many years. He was also a Member of the Mineralogical Society of London.

Fermor played a very prominent part in the establishment of the National Institute of Sciences of India. He was Chairman of the Committee constituted by the Indian Science Congress for the establishment of that Institute and was its first elected President in 1935. Those who have watched him during the period of work of the Committee would pay tribute

to the patience and tact displayed by him in solving the many difficulties which arose.

During the period of his retirement, after 1936, he was living in England, but took active part in the working of the Mineralogical Society, Geological Society and the Institute of Mining and Metallurgy in that country. He was also practising as a Consultant Geologist and paid visits to East Africa, South Africa and Malaya. He visited India in 1938 as a Member of the Delegation from the British Association for Advancement of Science to the Silver Jubilee Session of the 25th Indian Science Congress. In 1951 he was invited by the Government of India to the Centenary Celebrations of the Geological Survey of India, and he contributed an article on the history of the Geological Survey during its first 25 years from 1851 to 1876.

During the last few years of his service he began publishing parts of what he intended to be a comprehensive work on the Archæan geology of India. Unfortunately, only some four parts out of the projected 18 have been published. But those parts give an idea of his great and profound knowledge of the subject and it is regrettable that the work will now remain uncompleted.

Fermor was gifted with a capacity for taking enormous pains and going into the details of any problem referred to him for study. He was a hard task-master, but was always considerate and ready to give a patient hearing to even the most inexperienced colleague. It was very instructive to accompany him in the field for he was always ready to discuss and instruct, with his keen powers of observation and deduction. He was responsible for the starting of a departmental scientific club in which the officers explained to their colleagues the work on which they were engaged and which was debated upon. This geological club is still functioning vigorously in the Department.

Fermor is perhaps the last of the generation of geologists who may be called pioneers of Indian geology. He and his contemporaries, namely, C. S. Middlemiss, H. H. Hayden, R. D. Oldham, E. W. Vredenburg, G. E. Pilgrim and T. H. Holland have contributed a great deal to the understanding and solution of geological problems. With the passing of that generation closes the era of study of the broader problems of Indian geology. On the foundation laid by these and other earlier pioneers will the superstructure of Indian geology be built in generations to come. M. S. KRISHNAN,

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PERIODIC FADING OF MEDIUM WAVE RADIO SIGNALS

PERIODIC fading in short and medium wave signal strength records of distant transmitters taken during the early morning and late evening hours, was interpreted by previous investigators^{1,2} as due to the interference between two waves reflected either from one or two different layers of the ionosphere when one or both the layers have a slow vertical movement. They have calculated the vertical velocities of both the layers from the observed fading periodicities present in the records but their values showed wide variations. Further, it has not been possible for them to confirm these results by obtaining velocities by any other methods.

We have therefore undertaken a more detailed investigation on the determination of the

layer movements in the E-layer using medium wave transmissions. Using conventional equipment for recording signal strengths of continuous waves, fading records have been obtained for Madras A, Madras B and Cuttack medium wave transmissions during 0700-0800 hours. Almost all the records have shown complex periodic fading which is a superposition of three different types of periodic fading. Detailed analysis of the records revealed that there are two types of comparatively slow periodic fading and one type of a fairly quick period fading. All the three types of fading are interpreted as due to the interference of the three reflected waves from the E-layer. The slower periodicities correspond to 1 E & 2 E and 2 E & 3 E interference, whereas the quick period fading corresponds to the 1 E & 3 E interference. On the basis of this interpretation, the layer lifting velocities

are calculated from each of these periodicities and the values are found to be 2.15 metres per second for 1 E & 2 E interference, 2.29 m/s for 1 E & 3 E interference and 2.34 m/s for 2 E & 3 E interference. These values are found to be in good agreement with each other confirming the interpretation given by us. Further confirmation is obtained by the fact that both the 1 E & 3 E and 2 E & 3 E types of fading have lesser amplitude in view of the fact that the third hop from the E-layer is comparatively weak.

In the fading records obtained with Cuttack medium wave radio signals, the periodicities due to ground wave interference have also been noticed, possibly due to the appreciable signal strength of ground wave, Cuttack station being nearer (412 km.). The velocities as calculated from this periodicity are found to be in good agreement with the values obtained from the fading periodicities due to 1 E & 2 E interference. The average value of the velocity is about 2.37 m/s.

An important feature which has not been hitherto noticed is the decrease of velocity with time in the morning hours noticed in some of the records analysed. The analysis of such records is done by dividing it into four parts and taking the average velocity obtained from the different modes of interference present in each part. It is found that there is in general a definite decrease of velocity with time. At times, the variation is as much as 5 m/s to 2 m/s. It is evident from the above observation that the movement of the layer is rapid at the formation time during early morning hours and that it will gradually attain stable level after some time in the morning. Also it is found in most of the records that the amplitude or depth of fading decreases with time which can be explained as due to the increasing absorption of the radio waves in the intervening D-layer due to its growth in the early morning hours. Full details of these investigations will be published elsewhere.

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July 3, 1954.

DETECTION EFFICIENCY OF A PARALLEL PLATE COUNTER WITH GAS FILLING

THE counter used for these experiments has been described earlier.¹ In these experiments its detection efficiency for cosmic rays was measured by means of a coincidence circuit with the usual Geiger-Muller counter. For the present experiments a radioactive source, equivalent to 0.44 mg. Ra at a distance of 16 cm. from the lower plate was used. A special feature of the p.p. counter was the facility to adjust the parallelism of electrodes under applied high voltage, by which the field distribution in gap between electrodes was rendered uniform, thus effecting maximum utilisation of the electrode surface. High voltage on the counter was supplied by a stabilised h.v. rectifier from which voltage could be tapped at 2,000, 4,000, 6,000 and 8,000 volts. Fine adjustment of voltage on counter was achieved with the help of a dry cell battery of 700 volts, with tapings, connected in series with the rectifier. A simple thyatron circuit with slightly modified telephone call counter was used for counting the discharges (impulses). The influence of occasional radioactivity in the laboratory was eliminated by placing the counter in a lead box covered with thin aluminium sheet, which provided also electrostatic shielding.

Three easily available gases of different chemical nature (oxygen, carbon dioxide and air), were used for filling the p.p. counter. Some additional measurements were also made with nitrogen and argon. The gases had a purity of about 95 per cent. and were dried by passing through a vapour trap cooled with a mixture of dry ice and spirit (about $-80^{\circ}\text{C}.$). The experiments were made for each gas for four values of distance between electrodes (d): 3, 6, 10 and 20 mm. and with four voltage values (V) approximately 2,000, 4,000, 6,000 and 8,000 volts for each distance. For each voltage (V) the pressure of the gas was adjusted so that the discharges just started to pass through and then measurements were made of the variation of counting rate with voltage over a range (ΔV) of about 700 volts near V . Fig. 1 gives the variation of the number of counts per minute (counting rate) with the change in voltage (ΔV) for four values of V with the gas CO_2 . The curves obtained with other gases are similar, but the exact shape varied with the gas used. Since the number of counts per minute can be taken approximately as a measure of the current passing through the p.p.

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counter, these curves may be considered to be the current-voltage characteristic of the counter. Fig. 1 also exhibits the variation with ΔV

alcohol mixture drawn on the basis of results of measurements with cosmic rays reported earlier. The numbers over the points give rela-

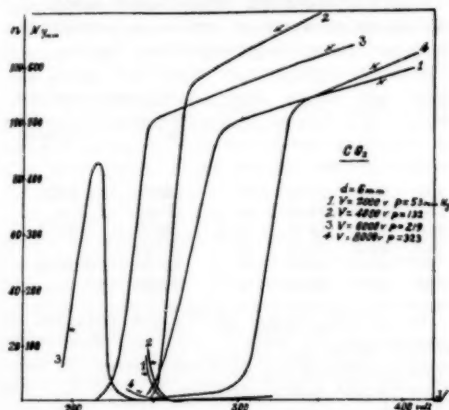


FIG. 1. Variation of Detection Efficiency and Impulse Number with Voltage Change.

of detection efficiency (n) defined by

$$n = (N_2 - N_1)/N_1.$$

Here N_1 is the number of counts per minute without the radioactive source and N_2 the number of counts with it. The individual points in Fig. 1 have a relatively large probable error, of the order of 40 per cent. which is partly due to the statistical errors and partly due to the fact that the stabilisation of h.v. rectifier was not good enough. However, the general trend of the data in Fig. 1 is clear enough. In all these curves it is noticed that n reaches its highest value (n_{max}) for relatively low value of N , very close to the point where the discharge just starts. Apparently, with the increase of voltage on the p.p. counter, even weak primary ionisation tends more and more to develop itself into discharges, increasing the number of occasional discharges (not produced by the action of the radioactive source), and consequently increasing the total dead time of the counter. This reduces the probability of development of discharges for primary ionisation caused by radioactive source and thus finally results in the decrease of n .

The average maximum detection efficiency for a distance (\bar{n}_{max}) was calculated by taking the average of n_{max} for the four values of the voltage. The variation of this quantity with the distance between the electrodes is given in Fig. 2. In addition to the curves representing results of measurement with three gases mentioned above, the figure contains also one curve for argon-

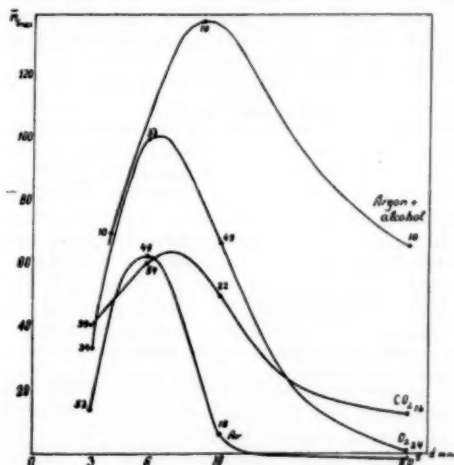


FIG. 2. Average Detection Efficiency as Function of Distance Between Electrodes.

tive errors in per cent. It can be seen from the curves that for each of the four gases of different chemical nature, the detection efficiency has a maximum value, and that it varies with different gases. In the voltage range between 2,000 and 8,000 volts the position of the maximum in the n - d curve varies between 5 and 10 mm. for the gases studied. The existence of a maximum in these curves may be explained as being due to two opposing factors. For a limited voltage range, with the increase of d , the probability of discharge development increases with the increase in thickness of gas layer (which increases the volume of possible ionisation and therefore the probability of discharge development also) while on the other hand it decreases with the decrease in field strength (V/d), which is the governing factor for the development of primary ionisation into a discharge.

These experiments were conducted in 1950-51 in the Physical Institute of the Hamburg University. I am indebted to Prof. Dr. E. Bagge for giving me facilities for the work.

Madras,
July 7, 1954.

A. SUSZKIN.

LOW TEMPERATURE CARBONISATION ASSAY OF SOUTH ARCOT LIGNITE

A SAMPLE of about one cwt. of lignite received from the Lignite Mines, Neyveli, was employed for this work. The proximate analysis of the lignite which was determined by standard methods is given in Table I.

TABLE I
Proximate analysis

	Air dry basis as received	Moisture-free basis
1 Moisture ..	15.7%	..
2 Volatile matter ..	48.8%	57.9%
3 Ash ..	3.28%	3.89%
4 Fixed carbon (by difference)	22.2%	38.21%
5 Sulphur (Eschka method)	0.78%	0.93%
6 Nitrogen ..	0.523%	0.62%
7 Calorific value (BTU/lb.)	9350	11090

The low-temperature carbonisation assay was carried out with the lignite ground to - 80 mesh and dried to constant weight at 105-110° C. The Gray-King Assay apparatus using an electrically heated tube-furnace was employed for the work. The temperature could be controlled automatically with the help of a Temcometer input controller to $\pm 5^\circ \text{C}$. 20 g. of moisture-free lignite were used for each experiment, the tar and liquor obtained being collected in a water-cooled condenser, whereas the gas, after scrubbing free of ammonia with dilute sulphuric acid, was collected over a glycerine-water mixture. The rate of heating was carefully controlled so that the final carbonisation temperature was reached at the end of an hour. Then the carbonisation was carried on at this temperature till the gas evolution became negligible, a period of nearly 2 hours being required for the process. The experiments were carried out at various temperatures ranging from 500-750° C. The characteristics of the chars obtained are given in Table II.

TABLE II
Proximate analysis of char

Temp. of carbonisation ° C.	Moisture-free basis			Cal. value BTU/lb.
	V.M. %	Ash %	Fixed C by diff. %	
500	22.3	5.6	72.1	14800
600	8.8	6.0	85.2	14110
700	5.7	7.8	86.5	13920

The yields of the various products, namely, char, tar, liquor, gas (ammonia-free) and of

ammonia obtained in the various experiments are shown in Table III.

TABLE III
Low temperature carbonisation assay
Yields of products at various temperatures
per 100 g. of moisture-free lignite

Temp. ° C.	Char (g.)	Tar. (g.)	Liquor (c.c. = g.)	Gas (Ammonia-free) c.c. 29° C.	Ammonia (g. of Ammonia sulphate)
500	58.6	10.2	10	16000	0.0222
550	50.0	12.0	10	20000	..
600	48.8	13.9	10.5	23320	0.0243
650	48.3	14.4	10	25300	..
700	47.2	14.7	11	25200	0.0466
750	47.3	15.0	11	26900	..

The calorific value of the gas obtained on carbonisation at 600° C. was also determined using a Jones-Miller Gas calorimeter. A mean value of 222 C.H.U. per cu. ft. (N.T.P.) was obtained.

With the increase of the temperature of carbonisation the yields of gas, tar and ammonia increase while that of the char decreases, and this variation is most marked in the range 500-600° C. of the carbonisation temperature. It was found that the time taken for attaining the final carbonisation temperature affects the yield of the gas generated, quicker heating increasing the yield especially in the range 450-600° C.

The low calorific value of the gas when compared to coal gas is due to the higher carbon dioxide and lower hydrocarbon contents of the gas. This is to be expected because lignites, as a rule, contain a higher percentage of oxygen, than coals.

A detailed paper on the results of this investigation will be published elsewhere.

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Madras-25, August 2, 1954.

ON A NEW FOSSILIFEROUS LOWER GONDWANA PATCH IN BANKURA DISTRICT, W. BENGAL

IN the course of a recent (1949-50, 1952-53) geological and mineral survey in the Bankura District, the author noticed a new fossiliferous Lower Gondwana patch extending over an area of more than 6 square miles. The patch lies between lat. 23° 15' and 23° 27' and long. 87° 13' and 87° 17' 30" approximately included in the Survey of India topo sheets 73 M/3 and 73 M/7 (scale 1" = 1 mile).

The formations comprise grey and reddish ferruginous shales overlain by coarse to medium-grained yellowish and greyish-white felspathic sandstones; the latter are sometimes seen to pass into coarse ferruginous sandstones near the surface. An impersistent layer of a pebbly bed about 2-3' thick and mostly composed of sub-rounded and rounded bluish and white quartzite pebbles (ranging upto 2½-3" in diameter) occurs in the sandstones overlying the soft grey shales. This pebbly horizon possibly indicates some break in sedimentation.

The beds are almost horizontal or dipping gently towards south-east and S.S.E. at angles ranging from 5-10° in most of the exposures. Occasionally, higher dips ranging from 15-25° in other directions such as towards east, north-east and north have also been noted.

The grey shales contain somewhat obscure plant fossils, while the reddish shales show distinct plant fossil impressions. The fossils found in these shales are:

Glossopteris indica, *Glossopteris retifera*, *Glossopteris communis*, *Gangamopteris* (?) cyclopteroids, *Samaropsis raniganjensis*, *Cordai-carpus* species and also *Vertebraria*.

According to Dr. K. Jacob, Palaeobotanist, Geological Survey of India, "this assemblage of plant fossils indicates that the beds in question are most probably Barakars and in any case not younger than the Raniganj". On the basis of the lithological and fossil evidences, these beds appear to belong to the Barakar stage of the Damuda series.

The exposed thickness of these beds as revealed in the stream and well sections of the area do not exceed 30-35'. The true total thickness of the formation could not however be ascertained owing to the absence of any relevant data (boreholes, etc.) but is likely to be more.

This Gondwana patch is surrounded on its three sides by laterites and patches of alluvium. It is probable that the Gondwana beds are likely to be found extending under the alluvium, laterites and some of the newly located tertiary formations. As such their areal extent may be considerably more than their present actual exposures.

In view of the possible Barakar age of these newly found Lower Gondwanas extending over a fairly large area, the author suggests that exploratory boring in the area may be worth undertaking to investigate the possible presence of coal seams (not exposed) at depths.

Geological Survey of India, A. HUNDAY.
Calcutta-13, June 28, 1954.

EFFECTS OF FOLIC ACID AND VITAMIN B₁₂ ON DEGRADATION OF PURINES BY *LACTOBACILLUS CASEI*

It is recognized that folic acid and vitamin B₁₂ influence the synthesis of nucleic acids in micro-organisms^{1,2} presumably through mediation in reactions leading to formation of purine and pyrimidine bases.³ The possibility is not excluded that the vitamins may also function by inhibition of purine breakdown reactions which result in formation of ammonia, acetic acid and carbon dioxide.⁴ *In vivo* and *in vitro* inhibition of xanthine oxidation by folic acid is known.^{5,6} A study was therefore made of the oxidative decomposition of xanthine and adenine by *Lactobacillus casei* (A.T.C.C. 7469) and the effects on it of folic acid and vitamin B₁₂ supplied in the growth medium.

The techniques of culturing and harvesting were as described before.² The degradation of the purine bases was followed from the liberation of ammonia as a result of the action of the resting cells in Conway micro-diffusion units.⁷ The system contained in a final volume of 3 ml., 1 ml. of cell suspension (24 hours harvest), 1 ml. of 0.2 M phosphate buffer, pH 7.4, and 0.5 ml. of substrate equivalent to 1 mg. of the purine. After incubation for 3 hours at 37° C., 1 ml. of a saturated solution of potassium carbonate was added and the tightly sealed unit kept at 37° C. for 1½ hours. The ammonia liberated was quantitatively absorbed in the central well in 2 N sulphuric acid and estimated by direct nesslerization.

The results using xanthine and adenine as substrates and with cells grown in media containing varying amounts of folic acid and/or vitamin B₁₂ are given in Table I. Corrections were made for endogenous release of ammonia.

TABLE I
Effects of folic acid and vitamin B₁₂ on purine degradation in *Lactobacillus casei*

Supplements per 100 ml. growth medium	NH ₃ per mg. dry wt. cells in the presence of	
	Xanthine	Adenine
Folic acid 5 µg.	.. 11.6	19.8
Folic acid 200 µg.	.. 7.4	18.2
Vitamin B ₁₂ 5 µg.	.. 9.3	18.6
Vitamin B ₁₂ 200 µg.	.. 7.5	17.6
Folic acid + Vitamin B ₁₂ 200 µg. each	16.4	17.9

Cells grown in presence of excess of folic acid or vitamin B₁₂ were less active in purine degradation. This was observed better in case of xanthine. The increased ammonia formation and the less pronounced effects of the

vitamins with adenine may probably be due to its primary amino group in the deamination of which these vitamins might have no influence. This was also inferable from the fact that the aspartic deaminase activity of the organism was not influenced by the two vitamins. The deamination of adenine in *Escherichia coli* is known to be preceded by transamination with inosine forming adenosine.⁸

Essentially similar results on the effects of folic acid and vitamin B₁₂ were observed in studies involving determination of acetic acid.

The depressing effect of folic acid and vitamin B₁₂ on purine catabolism is relatively less pronounced than their stimulation of nucleic acid synthesis.²

One of us (DVR) is indebted to the Raptakos Medical Research Board for the award of a fellowship.

Dept. of Chem. Tech.,
University of Bombay,
June 2, 1954.

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A. SREENIVASAN.

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STANDARDS FOR INDIAN COFFEE

A SURVEY of Food Laws¹ of various Indian States shows a wide disparity between inter-State specifications for coffees and in certain States, complete specifications have not been laid down. It was therefore considered necessary to obtain authentic data on the chemical composition of coffee grown in different regions of the country with a view to specifying uniform standards. The present study relating to the regional, varietal and type differences in the chemical composition of Indian coffee was undertaken on behalf of the Indian Coffee Board. The data presented in the present paper have been collected over a period of two years. In the meantime, two reports^{2,3} on the analytical figures for Indian coffee have appeared.

Forty samples belonging to *Arabica* variety and twenty belonging to *Robusta* were obtained through the courtesy of the Indian Coffee Board, from various regions of growth, namely,

Nelliampatti, Nilgiris, Annamalais, Kannan-devan, Pulneys, Bababudan, Shevaroy, Coorg, Biligiris and Naidubattam. All the samples were of Fair Average Quality (F.A.Q.). The coffee seeds were roasted in an electric coffee roaster to a medium roast and powdered; the powder passing through 30-mesh sieve was used for the analysis. Standard A.O.A.C. methods⁴ were followed except in the case of water extract. Water extract was determined by Jone's method,⁵ and tannins by indigo carmine method⁴ as used for tea.

The average chemical composition and range of analytical values for different coffees are given in Table I. Full details of the data on the regional, varietal and type differences in the chemical composition of coffee will be published elsewhere, but the salient features are as follows:

TABLE I
Average chemical composition of coffee powder
(40 samples—*Arabica*; 20 samples—*Robusta*)

	<i>C. Arabica</i>		<i>C. Robusta</i>	
	Mean %	Range of values %	Mean %	Range of values %
Loss on roasting	15.4	..	15.3	..
Moisture	2.5	..	2.62	..
Total ash	4.20	3.7-4.6	4.45	4.1-4.7
Water-soluble ash	3.22	2.64-3.86	3.38	2.95-3.77
Water-insoluble ash	0.98	..	1.07	..
Alkalinity of soluble ash (c.c. of N HCl/100 g.)	36.8	28.0-46.4	37.2	30.0-44.8
Total N	2.52	2.2-2.8	2.83	2.3-3.1
Crude protein (non-caffeine N x 6.25)	13.62	10.1-15.0	14.96	11.0-17.0
Caffeine (caffeine N x 3.464)	1.19	1.0-1.64	1.43	1.16-2.09
Pet ether extract	14.60	11.4-17.5	9.62	8.4-11.6
Crude fibre	17.30	14.6-22.2	18.13	14.3-21.3
Tannins	2.33	1.6-4.14	3.18	1.8-5.58
Water extract	29.3	26.3-32.9	29.8	28.1-31.7

(1) In general, no significant difference in the proximate composition is evident among the various types of coffee as cherries, plantation, flats and peaberry belonging to either *Arabica* or *Robusta* variety. The superiority in cup quality of plantations and peaberries over other types seem to be mainly in their taste and aroma.

(2) Regional differences in certain constituents have been observed as follows: (a) *Robusta* samples from Bababudan and Coorg showed maximum tannin content (4.86 and 3.96 per cent. respectively). It is worthwhile to study

TABLE II
Tentative standards for Indian coffee
(Medium roast)

Constituent	Not less than %	Not more than %
1 Total ash	3.5	4.8
2 Water-soluble ash	65% of total ash	..
3 Acid-insoluble ash	trace	..
4 Alkalinity of soluble ash (ml. N HCl/100 g. powder)	30	47
5 Water extract (Jones' method)	26	33
6 Caffeine	1.0	..
7 Total Nitrogen	2.2	3.1

if the quality of coffee is influenced by its tannin content. (b) The tannin content of *Arabica* samples from Shevaroy, Biligiri, Annamalai and Coorg is slightly higher (2.55-3.2 per cent.) than that of samples from other regions (1.8-2.45 per cent.). (c) The total nitrogen content of *Arabica* samples from Biligiri, Pulney, Bababudan and Coorg (2.58-2.72 per cent.) is slightly higher as compared to the samples from other regions (2.26-2.54 per cent.). (d) *Robusta* samples from Nelliampatti have shown the maximum content of caffeine (2.03 per cent.). Samples from Nilgiri and Annamalai have also shown higher caffeine content as compared to other regions (caffeine content of certain samples of Indian coffee has been found by Venkatachalam and Sundaram⁶ to be as high as 2.2-2.6 per cent.).

Based on our above data, the tentative standards proposed for Indian Coffee are given in Table II.

Acknowledgements are due to the Indian Coffee Board under whose auspices this work was conducted.

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July 8, 1954. (Miss) M. NAGARATHNAMMA.

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THE NATURE OF THE OXYGENATED
ACID FROM THE SEEDS OF *VERNONIA*
ANTHELMINTICA (WILLD.)

IN connection with the examination of oils showing abnormal values, work on this oil was commenced some time back and had almost reached completion, when a paper on the same topic was published by Gunstone.¹ The oil, obtained by extracting the seeds with benzene, was saponified with alcoholic potash, unsaponifiables removed, and mixed acids isolated. The lead salts of the mixed acids were subjected to repeated separation. The saturated acids were removed as the alcohol-insoluble lead salts and the alcohol-soluble lead salts repeatedly treated with light petrol and the insoluble portion decomposed with hydrochloric acid, esterified with ethyl alcohol-sulphuric acid and then acetylated by refluxing with acetic anhydride. The acetylated ester was purified by fractional distillation and gave an almost colourless oil, b.p. 232-34°/5 mm. The acid liberated had a saponification equivalent of 312.6, corresponding to 314 for dihydroxy octadecenoic acid. It is known that carboxylic acids will open the oxide ring. Thus, it is possible to convert an epoxide to the glycol monoacetate with acetic acid or to a monovalerate with valeric acid.² Thioacetic acid has also been used in this way.³ The present work shows that like acetic acid, acetic anhydride can also function in a similar manner. Periodic acid oxidation of the hydroxy acid yielded *n*-hexanal, also reported by Gunstone.¹ The acetylated ester was reduced with Adam's catalyst and then saponified to give dihydroxystearic acid, which was further reduced with P-HI to stearic acid. The same hydroxystearic acid was obtained by Gunstone¹ on reduction of the hydroxylated acid (obtained from the epoxy acid with acetic acid direct) with palladised carbon. The dihydroxystearic acid on periodate oxidation gave *n*-hexanal and an aldehydoacid, m.p. 64-66°, which on permanganate oxidation yielded *n*-dodecanedioic acid. Acetone-permanganate oxidation of the acetylated ester afforded azelaic acid and another acid which is under examination. Performic acid oxidation on the acetylated ester, followed by saponification, yielded two isomeric tetrahydroxy stearic acids of m.p. 123-25° and 146-48°, which are under further examination along with another tetrahydroxy stearic acid of m.p. 162-64° obtained by cold, dilute alkaline permanganate oxidation of the unsaturated acid resulting from the hydrolysis of the acetylated ester. The results presented here are complementary to those recorded by Gunstone¹ and

fully confirm his conclusion that the acid in question is 12:13-epoxy-octadec-9-enoic acid.

Maharaja's College,

P. S. RAMAN.

Ernakulam, August 7, 1954.

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EFFECT OF IODINATED CASEIN ON GROWTH IN CALVES

IODINATED proteins have been reported to stimulate growth in young growing pigs, mice, guinea pigs and chicks (Blaxter *et al.*¹). Trials with young heifers have not shown uniformly favourable results. Amongst the published literature only Millen *et al.*² and Dyrendahl³ report some improvement in growth in calves. The subject is of considerable interest in this country, as Indian animals have ordinarily slower growth rate than the Western breeds, and iodinated protein feeding might be of practical benefit.

In a previous communication by Sen *et al.*⁴ it was shown that calves fed iodinated casein at the rate of 2 g./100 lb. body weight exhibited a marked retardation in growth compared to the controls. This was accompanied by lower retention of N. An indication was also obtained that when the dose was reduced from 2 g. to 1 g., a sudden spurt in growth occurred. The present study was, therefore, planned to determine the effect of small amounts of iodinated casein on the growth of calves. Fifteen calves varying in age from 255 to 407 days were divided into 3 groups of 5 each. One group was kept as control and other two, Groups A and B, were given 1.25 g. and 0.75 g. respectively of iodinated casein per 100 lb. live-weight. At the end of the 12 weeks of treatment, the animals in Group B registered an increase in live-weight by an average of 75 lb. per animal as compared to 51 lb. by the control. This difference in growth rate was found to be statistically significant. During the same period, the animals in Group A also exhibited a higher growth rate (61 lb.) than the control, but the difference was not found statistically significant. All the thyro-protein administered animals, irrespective of being in Group A or B, showed statistically significant higher growth rate than the control when the treatment was prolonged to 20 weeks. The average daily rate of growth in 20 weeks in

controls, Group A and B was 0.65, 0.85 and 0.90 lb. respectively. At this stage, the administration of iodinated casein was withdrawn from the animals in Group A, whereas for those in Group B, it was increased at the rate of 2 g. per 100 lb. live-weight. The animals in Group A were found to maintain their relatively higher growth rate than the control for the next 15 weeks of observation. The increased administration of thyro-protein to Group B brought about definite retardation in growth within about 10 weeks, the daily average growth rate being 0.41 lb. It may be mentioned here that these experiments were carried out under a relatively temperate climate when the variation of temperature was between 86-55° F. and humidity 49-59 per cent.

These observations thus show that it is possible to accelerate growth in heifers by administering small doses of iodinated casein, whilst larger doses have adverse effect. Both control and experimental animals were given the same ration in proportion to their body weights. The results indicate improved food utilisation in presence of small doses of iodinated casein.

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July 2, 1954.

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M. C. RANGASWAMY.

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HORMONES AND ROOTING IN INTACT PLANTS AND CUTTINGS

THE investigations carried out and reported here relate to: (a) the rooting response of intact shoots of some common herbaceous and shrubby plants to different hormones and (b) to the root producing effect of indole butyric acid (IBA) and L-naphthalene acetic acid (NAA) on the cuttings of some common trees and shrubs.

Intact Shoots.—In intact shoots the hormones were applied by lanolin paste method. Lanolin paste containing hormones was applied 10 cm. below the apex of the stem in a 1.5 cm. broad-ring. In case of *Carica papaya* L. and *Corchorus* Spp., hormones in lanolin paste were applied on the lateral branches observed after

TABLE I

Material studied	Month of expt.	Hormones	Effective range of concentration %	% Rooting treated : untreated	Rooting time in days	General effect of rooting
<i>Carica papaya</i> L.	Aug.-Oct.	IBA	{ 3.0 5.0	100 : 0 100 : 0	33 31	+++ ++ 0
	do	NAA	..	..	..	0
<i>Corchorus olitorius</i> L.	June-Aug.	IBA	{ 5.0 10.0	100 : 0 100 : 0	19 18	+++ +++ 0
	do	NAA	..	..	..	0
<i>Corchorus capsularis</i> L.	do	IBA	5.0	100 : 0	20	++
	do	NAA	..	..	..	0
<i>Crotalaria juncea</i> L.	do	IBA	{ 5.0 10.0	100 : 0 100 : 0	22 21	++ ++ 0
	do	NAA	..	..	..	0
<i>Hibiscus subdariffa</i> L.	do	IBA	2.0	100 : 0	19	++
	do	NAA	..	..	..	0
<i>Lycopersicon esculentum</i> L.	July-Aug.	IBA	{ 1.0 1.5	100 : 0 100 : 0	15 21	+++ +++ ++
	do	NAA	..	..	..	0

* Proportion of rooting in treated branches to the untreated control.

0: nil, + < 5, ++ > 5, +++ > 10, ++++ > 15.

apical decapitation. The number of branches treated varied between five and ten. A summary of the effects of the different treatments on the production of roots in intact shoots is given in Table I.

In case of intact plants it is clear from the general responses of woody and herbaceous species that woody plants in general require a higher concentration of hormones than the herbaceous ones and thus the concentration requirements varied according to the nature of the plant.

Cuttings.—The effect of indole butyric acid and L. naphthalene acetic acid on the rooting of the cuttings of *Euphorbia pulcherrima* Willd., *Mangifera indica* Linn., and *Eugenia jambolana* Lamk. was investigated. Green wood cuttings (18 cm. long with intact apical region) were treated with hormones by standard immersion method (24 hours) and concentrated dip method (10 secs.). Experiment was conducted during summer (June-July), monsoon (August-October) and winter (November-January) seasons of the year. Concentration varied between 5 ppm. to 8 ppm. in standard immersion method and 2 mg./ml. to 10 mg./ml. in concentrated dip method. One set of the cuttings were planted in sand and the other in soil and there were three cuttings for each treatment.

There was induction of rooting in the cuttings of *Euphorbia pulcherrima* Linn.—when treated with Indole butyric acid (5 ppm. to 10 ppm.) during summer and monsoon seasons, and only when the cuttings were sown in the soil medium. In this plant there was no response in winter with any of the hormones and L. naphthalene

acetic acid failed to induce rooting in any of the treatments and seasons. In *Mangifera indica* Linn. and *Eugenia jambolana* Lamk. there was no response in any of the treatments.

From the responses towards rooting of different plants it is clear that relative effects of indole butyric acid and L. naphthalene acetic acid vary considerably according to genera and species, as also pointed out by Hitchcock and Zimmerman.¹

The rooting response is expected to be intimately related to the penetration of hormones through the epidermis and cortex up to the pericycle region, which is probably the reason why a comparatively higher concentration is required in case of woody species.

It is worthwhile mentioning that there are many plants which have not responded to auxin treatment in the production of roots. The reason for this appears to be not due to want of auxin, but rather to the lack of proper co-factors. Cooper and Stoutemeyer, Van Overbeek and others have shown clearly the importance of the presence of leaves on cuttings for the production of roots. Leaves can thus be said to provide co-factors which together with auxin cause root formation. Thus the elucidation of the relation between the nutritional condition of the cuttings and its capacity for rooting might prove useful, as was also pointed out by Sen.

Botanical Laboratory, J. C. SEN GUPTA.
Presidency College, S. K. CHATTOPADHAYA.
Calcutta, March 5, 1954.

¹ Hitchcock, A. E. and Zimmerman, P. W., *Contrib. Boyce Thomp. Inst.*, 1940, 11, 43.

RELATIVE TOXICITY OF SULPHA-
DRUGS TO WHEAT

SULPHONAMIDES are known to inhibit root-growth in the higher green plants.¹⁻⁵ Spraying of wheat-seedlings with the drug solution leads to chlorosis and even necrosis.⁶ The effect varies with the drug and its concentration.⁴ In the present studies, relative toxicity to wheat plants, of some sulpha-drugs (Irgafen, Sulphamezathine, M.B. 693, Sulpha-thiazole, Cibazol, Sulphatrid, M.B. 760, Sulpha-diazine, Septanellam and Sulpha-guanidine) has been investigated.

Grains of wheat (N.P. 165) were soaked (partly immersed) in 1 per cent. solution of the drug for (i) 24 hours and (ii) 48 hours and were immediately sown in soil in pots, the former in one half and the latter in the other half of each pot. Controls, soaked in water, were maintained. Observations on sprouting during soaking, germination in soil, growth and maturity were noted. Results with Irgafen and S-mezathine are presented in Table I. With the remaining drugs, in spite of satisfactory sprouting (the percentages varying between 82 and 100), germination was low (below 45 per cent.), and all the seedlings died soon.

TABLE I

	Control		Irgafen		Sulphamezathine	
Soaking period (hrs.)	24	48	24	48	24	48
Sprouting %	94	100	92.5	92.5	85.0	85.0
Germination %	95.0	90.0	70.0	65.0	60.0	45.0
Mortality %	nil	nil	28.6	23.0	16.6	11.1
Earing (days)	58	59	88	89	96	100
1,000 grain wt. g.	42.0	35.0	26.0	19.0	26.0	18.0

Even with such a high concentration of the drugs (1.0 per cent. solution), maximum inhibition in sprouting amounted only to about 18 per cent. but germination in soil was adversely affected, and the seedling mortality was high. The primary roots were stumpy and ageotropic; plumule-growth was slow and distorted; the first leaves were markedly succulent, dark green and narrow; tillering was induced early. Recovery in shoot-growth occurred after six weeks and the later growth was vigorous with normal foliage. Earing was delayed by 30 days with Irgafen and by 38 days with S-mezathine. Grain yields could not be compared due to unequal stand in the control and treated sets. However, 1,000 grain-weight indicates that the treatments led to shrivelling of grain.

Earlier workers,¹⁻⁴ who observed inhibition

in root-growth by sulphonamides in low concentrations (0.001 to 0.01 per cent.) grew the seedlings in test-tubes or petri-dishes with a continuous supply of the chemical; thus, results on growth and maturity were not available. The present technique of pre-sowing soaking does not seem to have been tried so far with these drugs.

Audus and Quastel⁴ observed that, at a concentration of 0.001 per cent., sulphanilamide and sulphapyridine were more toxic to root-growth than sulphaguanidine and sulphathiazole. In the present studies, the relative toxicity of the drugs appears to be: S-guanidine > Septanellam > M.B. 760 > S-diazine > S-trid > S-thiazole > Cibazole > M.B. 693 > S-mezathine > Irgafen. Experiments with lower concentrations than 1.0 per cent. are in progress.

Botany Dept.,
Agra College, Agra,
March 7, 1954.

S. N. BHARDWAJ.
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GREEN PYRALID CATERPILLAR AS
A NEW BORER PEST OF RATOON
JOWAR

THE author, during his survey of jowar pests from 1947 to 1951, has recorded the following five types of borers attacking the jowar stems in the Bombay Karnatak: Stem fly (*Atherigona indica* M.), Stem-borer (*Chilo zonellus* S.), Pink borer (*Sasamia inferens* W.), White borer (*Diatraea* Sp.), Green borer (*Anerastia oblutella*, Z.).

The green pyralid caterpillar was observed for the first time on ratoon jowar stems in the Dharwar Agricultural College Farm in April 1952. The damage caused was very severe. 1,188 stems were examined, out of which 605 stems showed "dead hearts". Out of these, 455 contained this caterpillar. The percentage of incidence works out to be 38.3 per cent. Since this borer is similar to the one described previously^{1,2,4} in respect of colour, spiracles, hooklets on the pro-legs and head capsule, it is tentatively identified as *Anerastia* (*Raphimetopus*) *oblutella*, Zell (sub-family *Anerastillinae*: family *pyralidae*).

The caterpillar was found boring at the base of the newly formed stems of the ratoon jowar, either near the surface of the soil or just below it, incidentally producing the same nature of damage as the other borers, i.e., showing dead hearts.

Detailed morphological, life and seasonal history studies under local conditions are in progress. It has been previously recorded by Mackenzie² on sugarcane in Bihar, on Nagarmoiha grass (*Cyperus rotundus*) in the Central Provinces by Fletcher and Ratiram³ and by Fletcher and Ghosh⁴ at Pusa causing dead hearts in young sugarcane.

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College of Agriculture,
Dharwar, June 8, 1954.

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MALFORMATION OF PANICLES IN MANGO INCITED BY A SPECIES OF ERIOPHYES

A POTENTIALLY serious disease of mango (*Mangifera indica* L.) affecting the inflorescence has been observed in Poona. The inflorescence is completely malformed into green witches' broom-like structures and bears small leafy outgrowths in place of normal flowers. The disease appears to be well established in Poona, and as many as 400 trees that were examined in the precincts of the city area were found to have this type of infection. Other areas have not yet been surveyed for the prevalence of the disease. In some of the trees all the inflorescences of the current season appeared to have been affected and in others only a few inflorescences were diseased. Various reasons for this type of malformation appear to have been adduced, including the possibility of virus infection. Mundkur in his "Fungi and Plant Disease" illustrated the witches' broom malformation of mango inflorescence and suggested in a general way that "both hypertrophy and atrophy may be responsible for such development".

The diseased panicle shows its characteristic symptom even from the early stages. The peduncle becomes thick, green and fleshy and branches profusely (Fig. 1). Numerous small leafy structures crowded together (Fig. 2) are borne, and the whole structure presents a witches' broom appearance. Each group of leafy

structures represents a single malformed floret of the inflorescence. No fertile flowers are ever borne on these diseased panicles.



FIGS. 1 and 2

FIG. 1. Photograph of the malformed inflorescence.
FIG. 2. Enlarged view of the malformed florets.

Microscopic examination of sectioned material of the diseased panicles and florets has shown that the disease-inciting organism is a species of *Eriophyes* which are known to produce various types of galls and woolly excrescences on plants. In the case of diseased mango inflorescence, the mites are present in great numbers in the meristematic regions and tender portions of the peduncle. Within the host tissue numerous lacunae are produced, and in these, all the stages of the developing mite may be observed. The anatomy of the cortex and stele of the inflorescence is considerably transformed accompanied by the development of hyperplastic cells. The *Eriophyes* species under study has been observed to produce disease symptoms only on the inflorescence. Similar floral abnormalities have been reported on various hosts in other countries. *Eriophyes malphigianus* Can. & Mass. has been reported to cause floral hypertrophy in *Laurus nobilis*.¹

From a survey of the percentage of infection and distribution, the disease appears to be a potential danger to mango crop. Some of the dried inflorescences of the previous year's

infections, were found to contain living mites. *Oidium mangiferae* Berth. which causes damage to tender leaves during the growing season, is noticed to develop profusely later on the malformed inflorescences, produced by the infection of *Eriophyes* sp. In the absence of any data on the use of acaricides and particularly the systemic insecticides for controlling the disease, prompt removal and burning of the diseased inflorescences should be taken up immediately.

For the facilities afforded to carry on this investigation in M.A.C.S. Laboratory, Poona, the author is indebted to Prof. S. P. Agharkar. Poona, M. J. NARASIMHAN.
June 20, 1954.

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PRODUCTION OF FRUCTIFICATIONS OF *MARASMIUS CAMPANELLA* HOLTERM. IN CULTURE

WHILE investigating the decays of standing trees of *Lagerstræmia speciosa* (L.) Pers. caused by *Marasmius campanella* Holterm., the authors experienced great difficulty in obtaining typical fructifications from the isolates of the organism from the rotted areas and also from the spore-cultures of *Marasmius campanella* growing luxuriantly over the trunks and branches of the affected trees. However, typical fructifications could be subsequently obtained by various trials and a brief account of the same is given below.

Like many other Basidiomycetes, the isolates as well as the spore-cultures of *Marasmius campanella* remained sterile in culture tubes containing such media as potato-dextrose agar, malt agar, wood-decoction agar, etc., under normal conditions of temperature, humidity and light of the laboratory. Eventually, the accelerator and also the methods for developing fructifications as recommended by Badcock^{1,2} were tried. Dry saw-dust of sound sapwood of *Lagerstræmia speciosa* was mixed with Badcock's 'accelerator' in various proportions (5-40 per cent. by weight). The mixtures were then soaked and put in Petri-dishes and in test-tubes. After sterilization, the media were inoculated with the isolates and also with the monosporous and polysporous cultures of the fungus in question already made available for the purpose. The cultures were then kept in darkness and at a constant temperature of 30° C. In all cases the growth started with much rapidity and produced white, luxuriant mycelial growth on this medium particularly

on those containing 30-40 per cent. by weight of the 'accelerator'. In none of the cultures did even the rudiments of fructifications appear within 1½ months from the date of inoculation. At this stage various devices were tried by placing them in an atmosphere of relatively high humidity. Some of the cultures of the isolates in Petri-dishes were kept in diffused light and room temperature (28-29° C.) of the laboratory with their lids open under bell-jars lined inside with moist blotting-paper. In the medium containing 5 per cent. 'accelerator', roundish, white mycelial knots appeared at the edge of the Petri-dishes within next 48 hours. These knots elongated considerably on the following day and gradually formed two well-developed centrally stipitate fructifications within 4-6 days from the date of exposure (Fig. 1, A & B). Several such fructifications

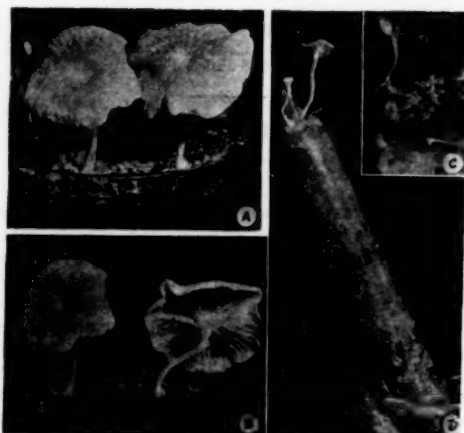


FIG. 1. Typical Fructification of *Marasmius campanella* formed in Culture (size reduced).

were also obtained in other Petri-dishes from monosporous cultures (Fig. 1, C). It was noticed that the media containing higher percentage of the 'accelerator' (20-40 per cent.) favoured vegetative growth, as such fructifications did not appear on them even when kept under identical conditions. Successful production of fructifications in this way induced the writers to expose similar cultures on potato-dextrose agar and malt agar media in Petri-dishes within moist bell-jars under identical conditions. Although there was the risk of contamination, this method also proved to be successful. Fructifications appeared on these media at the rim of the Petri-dishes within 48 hours from the time of exposure. This fact

indicates that cultures well supplied with suitable amount of food can be induced to produce normal fructifications of *Marasmius campanella* under the combined influence of high humidity (90-100 per cent.), aeration, temperature (28-30° C.) and possibly diffused light. It also points out that Badcock's medium is not an essential factor for this purpose.

In order to obtain fructifications from spore-cultures in test-tubes, a new method was devised. When the mycelium completely filled the saw-dust medium in culture tubes and became compact, a small opening was made at the base of each tube by carefully breaking the glass. Its plug was replaced by a sterile absorbent cotton plug which was pushed inside the tube in such a way that it came in contact with the medium while the other end of the plug slightly projected outside the rim of the culture tube. The tube was then placed in an inverted position in a beaker containing distilled water so that by capillary action through the cotton-plug a constant supply of water to the medium was maintained. The whole apparatus was kept within a moist bell-jar under the conditions already mentioned. It was only in the tubes containing 5 per cent. 'accelerator' the mycelium grew out at the broken end of the tube at first forming a cottony and fluffy growth within 5-6 days after exposure. Mycelial knots began to appear on the 8th day and within the next 24 hours fully developed fructifications were obtained (Fig. 1, D). In other cases several knots began to elongate simultaneously but only one of them soon took the lead to form a normal fructification while others became abortive. The fructifications copiously discharged spores on the surface of the culture tubes for several days.

The size of the fructifications varied considerably. The diameter of the pileus was 12-20 mm. and the stipe was 10-20 mm. long. In the majority of cases the fructifications were centrally stipitate. In all cases sections of the gills showed well-developed hymenia with normal disterigmatic and bisporous basidia agreeing closely with the measurements of those obtained in nature.

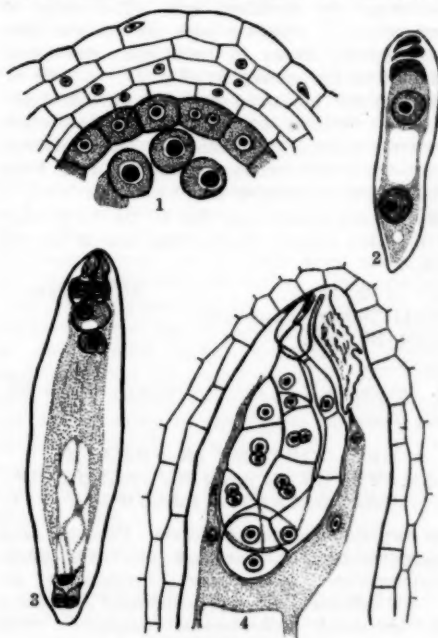
SACHINDRANATH BANERJEE.

Dept. of Botany, NIRMALENDU MUKHERJEE.
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CONTRIBUTIONS TO THE FLORAL MORPHOLOGY OF *TERMINALIA CHEBULA* RETZ.

Terminalia chebula belongs to the family Combrētaceae. The present note deals with certain aspects of the floral morphology of this species.



FIGS. 1-4.

FIG. 1. Anther lobe showing the epidermis, middle layers and tapetum, $\times 287$.

FIG. 2. Two-nucleate megagametophyte, degenerating megaspores still persisting, $\times 287$.

FIG. 3. Mature megagametophyte, $\times 72$.

FIG. 4. Two embryos in a single embryo sac, $\times 72$.

The wall of the anther consists of four or five layers of cells in addition to the epidermis; the innermost of these forms a secretory tapetum (Fig. 1). The mature pollen grains are binucleate.

The ovary is inferior, unilocular and contains usually two ovules which are bitegmic, crassinucellate and anatropous. Only one of the ovules develops into a seed; the rest degenerate and are crushed by the developing seed. Megasporogenesis proceeds normally and the development of the megagametophyte corresponds to Polygonum Type. The synergids show a filiform apparatus. The antipodals degenerate early (Figs. 2, 3).

Endosperm is nuclear and the first division of the primary endosperm nucleus takes place

before that of the oospore. Endosperm is completely consumed by the growing embryo.

Usually only one embryo is developed in each ovule. In a single case, however, two embryos have been found in the same embryo sac. One of the embryos is normal and therefore is developed from the fertilized egg. The other is found near it. Judging from its position this extra embryo seems to have been developed from one of the synergids (Fig. 4). A case of polyembryony has been reported by Venkateswarlu¹ in *Poinciana coccinea* DC., (*Combretum coccineum* Lamk.) a member of Combretaceae, where the extra embryo seems to have been formed from a nucellar cell.

My sincere thanks are due to Dr. L. N. Rao for his kind interest during the course of this work.

Dept. of Botany,
Central College, Bangalore,
August 10, 1954.

M. NAGARAJ.

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DNA CONTENT IN FEMALE GAMETOPHYTE AND NUCELLUS OF *TRADESCANTIA PALUDOSA*

THE original theory of Boivin, Vendrely and Vendrely¹ that the amount of DNA (Desoxyribonucleic Acid) per chromosome set of a species is approximately constant has obtained considerable support from later studies, notably those of Vendrely and Vendrely,² Mirsky and Ris,³ Ris and Mirsky,⁴ and more recently by Swift.⁵ There has however been some disagreement from these views, more especially presented by Lison and Pasteels⁶ who failed to find any constancy of DNA in tissue nuclei of a species or any correspondence between amount of DNA and degree of ploidy.

While a considerable amount of work on the quantitative estimation of DNA has been done on animal tissues, nearly the same attention has not been directed to the analysis of plant nuclei. And the little that has been done presents conflicting evidence in regard to the constancy of DNA in the different tissues of the plants examined. For instance, Schrader and Leuchtenberger⁷ found no constancy in the amount of DNA in the different tissues of *Tradescantia* while extensive observations of Swift⁵ in this plant indicated the presence of three or even four different values, depending perhaps on the degree of ploidy in the nuclei of the tissues examined. Bryan's⁸ studies

showed no regular ratios. On the other hand, biochemical analysis by Ogur *et al.*⁹ of different yeast strains showed a regular correspondence between DNA amount and degree of its ploidy.

A photometric analysis was made of the DNA content of the nuclei of the female gametophyte and the surrounding nucellus of *Tradescantia paludosa*. The mature gametophyte which is 8-nucleate and haploid is surrounded by nucellar cells whose nuclei are diploid, and it was felt an analysis of these should be useful in determining the relationship between ploidy and DNA amount. The measurements were made of Feulgen stained nuclei in Dr. H. Swift's laboratory, University of Chicago, Ill., U.S.A. The photometric apparatus is described by Swift.⁵ The data obtained are given in Table I, which represent the mean of 18 measurements.

TABLE I

	Gametophyte (n)	Nucellus (2n)
Diameter of nucleus (μ)	5.7	5.9
Volume of nucleus (μ^3)	96.94	107.5
Extinction (E)	0.400	0.791
Relative amount (E/μ^2)	23.7	47.8
Relative concentration ($E/\frac{1}{3}r$)	0.105	0.211

It will be seen that a very striking correspondence between the degree of ploidy and DNA amount exists in the tissues examined.

My sincere thanks are due to Dr. H. Swift for his kind interest and helpful suggestions.

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**BACTRONOPHORUS THORACITES
(GOULD) AS A PEST OF LIVING TREES
IN THE SUNDARBANS, BENGAL
(MOLLUSCA: TEREDINIDÆ)**

The marine borer *Bactronophorus thoracites* (Gould) (Mollusca, Eulamellibranchiata, family Teredinidae), is an Indo-Australian species which has hitherto been recorded from Burma by Gould¹ and from the Dutch Colonies in the Indian Ocean (modern Indonesia) by Gray² as boring the timber of jetties and wharves in harbours; there is so far no record from India.

During a survey of the 24-Parganas Forest Division in the Sundarbans, Lower Bengal, in January 1954, I found this borer doing serious damage to several species of living trees in the forests of the Kankramari and Lothian Islands, and it probably occurs all along the coastal regions of the Sundarbans which are subject to submergence under sea-water during the spring tides. This is the first record of *B. thoracites* from India and also probably the first record of a Molluscan marine borer doing damage to living trees.

The affected trees are found to be riddled with vertical galleries in the lower portion of the trunk, the galleries also extending into the tap-root for some distance. A medium-sized tree (about 25' high and 1' girth at 4½' height) may contain as many as ten live borers. As a result of the boring, the tree gets weakened and topples over in a strong gust of wind. A large proportion of the forest trees near the coastal region showed the attack.

A fuller account will be published elsewhere.
Forest Res. Inst., M. L. ROONWAL.
Dehra Dun, June 28, 1954.

1. Gould, *Proc. Boston Soc. Nat. Hist.*, Boston, 1856, 6, 15.

2. Gray, J. E., *Proc. Zool. Soc. London*, 1861, 313.

**DIE-BACK OF CHILLIE (*CAPSICUM
ANNUUM* L.) CAUSED BY
ALTERNARIA SP.**

A MONTH-AND-A-HALF after transplantation the chillie crop on our farm showed scorching of the tips of the branches which extended downwards blackening stems and leaves and subsequently killing them. Although the symptoms were similar to those of "Die-back on chillies" described by Dastur¹ the acervuli of the causal organism, viz., *Colletotrichum* was not found to be associated with the present disease. Some of the mildly infected leaves were found to develop black spots with concentric rings. Microscopic examination of the scraping of the spots on leaves revealed the presence of *Alter-*

naria spores. Platings of surface sterilized (mercuric chloride 1:1,000) infected leaves of chillies on potato-dextrose-agar medium yielded pure culture of *Alternaria* sp. Single spore culture of this fungus was made and spore suspension of the same in sterile water was sprayed with the aid of an atomiser on injured and uninjured chillie plants grown in pots under laboratory conditions (day temperature 104-08° F.). The injury was effected by pricking the tips of the branches with needle. Plants similarly injured but sprayed with sterile water served as control. The plants of the injured series took infection 3 days after inoculation, blackening of stems progressed rather rapidly and the plants completely withered on the tenth day. The uninjured series on the other hand manifested symptoms 28 days after spray and the plants withered gradually. The controls, however, remained healthy. The organism was recovered from the artificially infected plants on plating after surface sterilization, thereby confirming that the causal organism was *Alternaria* sp. Studies on morphology, physiology and pathogenicity of the fungus on other host plants are now in progress.

Biology Dept., J. C. EDWARDS.
Agric. Inst., Allahabad, R. N. SHRIVASTAVA.
May 15, 1954.

1. Dastur, J. *Mem. Dept. Agric. India*, 1921, II, 129.

**GALACTOGEN IN SOME COMMON
SOUTH INDIAN GASTROPODS WITH
SPECIAL REFERENCE TO *PILA***

THE present note deals with the occurrence of galactogen in the reproductive system of a few common South Indian Gastropods. For the extraction of galactogen the method given by Baldwin and Bell¹ was followed. Galactogen was detected by hydrolysing it to galactose and testing the galactose by the osazone test, phloroglucinol test and mucic acid test. The materials used for the present investigations were the uterine portion of the reproductive system of *Pila* and the albumen gland in the case of *Viviparus* and *Ariophanta*. In the case of eggs, the albuminous fluid as a whole was used for analysis.

The uterus of fully mature specimens of *Pila* was employed for the quantitative extraction of galactogen. It was observed that about 28 per cent. of the dry weight of the uterine tissue was galactogen. The developing stages of the uterus taken from juvenile animals also contain a certain amount of galactogen. As the size of the uterus increases, the galactogen content also increases. In the earliest stages exa-

TABLE I

Substance	Active life		Aestivation period in months						
	Sexually active period	Well-fed animal before aestivation	1	2	4	6	8	10	12
Galactogen (grams per 100 g. of uterus)	28.5	24.5	24.5	24.5	24.6	24.2	20.0	16.2	13.6
Glycogen (grams per 100 g. of foot)	1.9	10.1	9.7	9.3	7.2	5.6	5.5	5.2	5.2

mined by me, the galactogen content was about 7.4 per cent. of the total dry weight of the uterus. In later stages it gradually increases, reaching a maximum of about 28 per cent. found during breeding period.

It was observed that there is a sudden decline in the galactogen content after oviposition, though there was no complete depletion, the galactogen content falling to 14-15 per cent. Within a few weeks after egg-laying, the galactogen content was found to increase again, and to reach a value of about 24-25 per cent. before aestivation.

In *Viviparus*, the albumin gland in the reproductive system contained about 30 per cent. by dry weight of galactogen. In *Ariophanta* the albumin gland contained a slightly higher percentage of galactogen. The albuminous fluid of the eggs of *Pila* was also found to contain a good amount of galactogen.

The food of the adult *Pila* consisting of aquatic plants like *Vallisneria* was analysed, but no trace of galactogen or galactose was found. It is evident, therefore, that the animal does not get its supply of galactogen as such in its food and that the presence of a large quantity of this polysaccharide in the animal implies that it is synthesised in the tissues of the animal from a monosaccharide like glucose which is available normally in the animal by the digestion of starchy food.

The galactogen content of the uterus and the glycogen content of the foot (glycogen is present in the foot only) in the different states of activity of the animal have been studied. The results are shown in Table I.

During the reproductive period the glycogen content of the animal is very low being about 2 per cent. of the dry weight of the foot. Later, after the reproductive period, it rises to about 10 per cent. During prolonged aestivation the galactogen content of the uterus declines. The portion of the uterus which is normally swollen becomes much shrunken and the relative weight of the uterus itself decreases as also the galactogen content. The glycogen content of the animal during this period shows an interest-

ing feature. Before aestivation it is high and after declining to some extent shows little fluctuation over a long period. This quantity which is about 5 per cent. is much higher than that present during the breeding season. It is reasonable to assume that the constancy of the glycogen which is the most important source of energy for the animal and the decline of galactogen are related, glycogen level being maintained probably by conversion of galactogen, as its derivation from food during aestivation is out of question. The great increase of galactogen to 28 per cent. and the marked decrease of glycogen to about 2 per cent. during the reproduction period would also point to the conclusion that there is probably inter-conversion of galactogen (or galactose) to glycogen (or glucose) and vice versa, according to the needs of the animal. Further work is in progress.

My thanks are due to Prof. R. V. Seshaiya for guidance.

Dept. of Zoology, (Miss) V. R. MEENAKSHI.
Annamalai University,
Annamalainagar, April 24, 1954.

I. Baldwin, E. and Bell, D. J., *J. Chem. Soc.*, 1938, 1461.

ON THE "SENSORY EPIDERMIS" OF STIPULES OF *VITIS REPENS* W. AND A.

WHILE studying the development and histogenesis of the tendrils and stipule of *Vitis repens*, a striking histological feature of the abaxial epidermis of the 5th, 6th and subsequent pairs of stipules was noticed. It indicated that these, specially the 5th to the 7th pairs from the shoot apex, probably act as the organs of perception of mechanical stimuli, directing the plant in climbing round the support.

The growing tip of the shoot of *Vitis repens* appears ear-shaped. It usually consists of 5-7 pairs of stipules which remain folded together with 5-7 developing leaves and tendrils. The stipules are not persistent. Fig. 1 is a diagram of a stipule near the apex. The letter *a* indicates the region of attachment of the stipule with the node. The part of the stipule below

a consists of two auricular lobes which partly envelop the internode on the sides.

Longitudinal corrugated thickenings are observed on the outer wall of the abaxial epidermis of the 6th and subsequent pairs of stipules (Fig. 4). On the 5th pair of stipules, they were observed only on the cells near the margin. In cross-section they appear tooth-like. The adaxial epidermis is without such thickenings (Fig. 3), except a single row form-

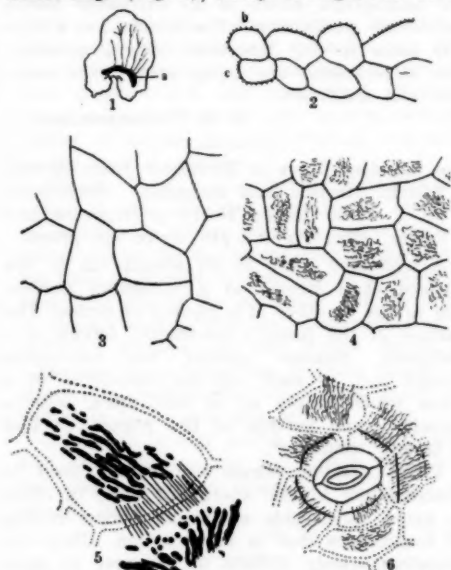


FIG. 1. A typical stipule, $\times 2$. The region in black indicates the position of its attachment to the node.

FIG. 2. Cross-section of the 6th stipule near the margin, $\times 500$. *b* and *c* denote abaxial and adaxial surface respectively.

FIGS. 3 and 4. Surface view of adaxial and abaxial epidermis respectively, $\times 220$.

FIG. 5. Portion of Fig. 4 magnified, $\times 567$.

FIG. 6. Surface view of abaxial epidermis with a stoma, $\times 300$.

ing the edge of the stipule (Fig. 2). It is significant that the outer wall of the abaxial epidermis bulges out with the characteristic thickenings very prominently developed only in its central part (Figs. 2 and 5). They are absent or poorly developed in the auricular portion of the stipule. Even the subsidiary cells of the stomata (Fig. 6) show similar thickenings which also occur on the epidermis of the tendrils. Haberlandt¹ (pp. 572 and 577) describes this as "sensory epithelium" or "sensory epidermis". Goebel² has referred to the protective and assimilative function of the stipules. The histological features of the abaxial epidermis indicate that in *Vitis repens*

the stipules, specially 5th-7th pairs, probably perform the function of perception of the external mechanical stimuli.

I offer my grateful thanks to Prof. P. Maheshwari for his help and encouragement and to Shri I. N. Solanki for facilities.

Dept. of Biology, J. J. SHAH.
M.T.B. College, Surat, June 1, 1954.

1. Haberlandt, G., *Physiological Plant Anatomy*, 1914, Macmillan & Co., Ltd., London.
2. Goebel, K., *Organography of Plants*, Part 2, 1905, Oxford Clarendon Press.

VENTRICULAR GLANDS OF *GRYLLIDAE* *TALPA AFRICANA* BEAUVOIS (*GRYLLIDAE*: *ORTHOPTERA*)

It has been recorded that in *Gryllidae*, the cardia of the ventriculus has a pair of gastric cæca. In *G. africana* besides a pair of gastric cæca there are present two pairs of branched gland-like structures. These structures are situated between the gastric cæca on the cardia of the ventriculus and are gland-like, and therefore, they are being called as *ventricular glands*. Sayce¹ studied the structure of the alimentary canal of *G. australis* in detail, but he has not mentioned about these glands at all. In fact the presence of the ventricular glands has not been recorded in any other insect.

Each gland (Fig. 1) is branched, tree-like and consists of a large number of tubes. Each

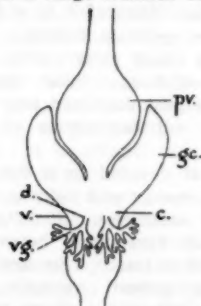


FIG. 1. *c*, Cardia; *d*, duct of the ventricular gland; *gc*, gastric cæcum; *pv*, proventriculus; *v*, ventriculus; *vg*, ventricular gland.

tube is branched, each branch ends blindly and becomes swollen at its blind end. Each gland opens separately into the cardia through its duct. All the four glands may not be of the same size, i.e., some may have a large number of branches while others may have only a few. Each gland is about 3.0 mm. long.

Dept. of Zoology, R. RAKSHAPAL.
The University, Lucknow, May 12, 1954.

1. Sayce, O. A., *Proc. Roy. Soc. Victoria*, 1899, 11, 113.

REVIEWS

Signal Noise and Resolution in Nuclear Counter Amplifiers. By A. B. Gillespie. (Atomic Energy Establishment, Harwell.) (Pergamon Press, Ltd., London.) Pp. 155. Price 21 sh.

This monograph deals with an important aspect of the technique of electronic counting of nuclear radiations. Randomly spaced pulses of about a few microvolts to some millivolts, depending on the initial ionising event, are obtained from nuclear detectors such as the ion chamber and proportional counter. These pulses have to be amplified to a level of about 30-40 volts for amplitude discrimination and recording. The time constants, signal to noise ratio, resolution and sensitivity of such amplifiers form the subject-matter of this book.

Chapters 1 and 2 are largely introductory, while the different types of noise are dealt with in Chapter 3. Their magnitudes in some of the special valves, used in the amplified input stage, are discussed, and these data are bound to be of help in the design and use of such equipment.

The next chapter discusses signal to noise ratio and its dependence on amplifier constants. The author has illustrated how this ratio and resolution are opposing factors; one can only speak of the 'best value' with respect to a particular resolution. Pulse shaping and its usefulness are next discussed and the delay line and ringing coil techniques of shaping are analysed.

Chapter 5 is devoted to a discussion of the sensitivity in energy and activity measurements with typical examples. Results are quoted, showing good agreement between measured and calculated values. This and the previous two chapters present valuable experimental data and the original methods of analysis by the author, which form an outstanding contribution to the subject. The last chapter deals with proportional and scintillation counters, with a very useful discussion on the 'pile up' of unwanted pulses.

A noteworthy feature of the book is the lucidity of the text. Every topic is clearly introduced before the detailed discussion that follows. The mathematical portions have been properly relegated to the appendix so that it is easy to follow the physical basis. Even so, some of the integrations done in the appendices could have been left out; instead, an elabora-

tion of the last chapter and perhaps some additional details of noise measurements would have been welcome.

This, however, is a very minor point about the monograph which is an extremely useful and timely publication. The volume has a definite place in any laboratory where quantitative experiments are being made with counters and amplifiers.

K. S. CHANDRASEKARAN.

The Standing Wave or Hydraulic Jump. Second Edition. Revised and Enlarged. Publication No. 7 of the Central Board of Irrigation and Power, 1950. Pp. x + 146. Price not given.

A hydraulic jump is an abrupt lift in the surface of a stream at a stationary section, due to one or other of a variety of causes. The surface at the jump is constantly falling in a turbulent manner against the on-coming stream and, as such, can be considered as a wave which moves up at that place, with a velocity equal to that of the stream, so that it is left "standing".

These standing waves are mainly used to dissipate the kinetic energy of flow, in order to avoid undesirable effects like under-cutting of foundations due to scour action. They are therefore widely utilised at the rear of dams and weirs and below regulators, sluice gates, drops, etc.

The book under review is a revised and enlarged edition of an earlier publication issued in 1934, written by A. M. R. Montague. In the present edition, issued by the Central Board of Irrigation and Power on 15th August 1950, the subject has been brought up to date and a number of new chapters have been included. The draft of this new edition was prepared by Dr. N. N. Bhandari, then Assistant Secretary of the Central Board of Irrigation and Power, and scrutinised by an authoritative Committee of top-ranking workers in the field, within the country. A very useful and fairly complete bibliography is also appended.

Though the publication is mainly intended as a handbook for use by the engineers and research officers in the different hydraulic laboratories within the country, it will be found equally valuable by all students of hydrodynamics in general.

T. N. SESHADRI.

Planetary Tables, Vol. I. (Tables of Mercury.)

By Harihar P. Bhatt. (Gujarat Vidya Sabha, Ahmedabad), 1953. Pp. viii + 20 + 18. Price Rs. 2.

This book of tables helps one easily to compute with sufficient accuracy the position of the planet Mercury at any time. The best source available for the purpose is no doubt Prof. Newcomb's, which is not easily available now.

The heliocentric co-ordinates of Mercury are given with the necessary formulæ and references for conversion to geocentric co-ordinates and apparent R.A. and declination. The relativity correction is however omitted, which is rather a minute quantity, though appreciable in the case of mercury.

Though these tables do not enable one to calculate the planetary position as accurately as Newcomb's tables, they are easier for computation and the maximum error in the observed time of transit is only 0.7 of a second of time, and that in the geocentric latitude is only a second of arc. For the computation of the different almanacs in the Indian States and observers, these tables are accurate enough and simpler in manipulation than many other published in India and outside.

This book is very useful and handy to almanac computations, and the author deserves to be congratulated on bringing out such a creditable work.

H. SUBRAMONI IYER.

Primates—Comparative Anatomy and Taxonomy. Vol. I. *Strepsirhini* (lemurs, lorises and galagoes.) By W. C. Osman Hill. (Edinburgh University Press), 1953. Pp. xxiii + 798. Price £5 sh. 5 net.

In the forty years that have elapsed since the publication of the last monograph of Primates by Elliot, a considerable amount of diverse information has accumulated on the group. This cumulative knowledge has been ably arranged and critically reviewed by Osman Hill in the volume under review. He has introduced freshness in the subject by bringing in new data and reassessing the older ones.

The most outstanding feature of the work is its thoroughness, there being hardly any aspect that has been left out. One may not agree with the qualifying expression "Comparative Anatomy and Taxonomy" to the title of the book; "Primates" alone would have done.

The ultimate aim of a systematist is to arrive at a natural classification, to achieve which he

needs to consider not only the external and internal morphology of the animal, but also its biology. This has been pre-eminently fulfilled by Osman Hill and his work may indeed serve as a model.

This volume begins with a short general introduction to the Primates. It includes a pithy discussion of the definition of the order and of its external characters, skeleton, dentition, brain and sense organs, reproduction, placentation, distribution, taxonomy, phylogeny, etc. Perhaps many will welcome the author's decision to exclude the Tupaiids (tree shrews) from the Primates, not because their affinities are denied, but because it is generally considered undesirable to cause violent changes in the older classification by shifting such borderline forms from one group to the other, and thereby giving a new conception to the groups. Regarding the grouping of *Tarsius* with the higher Primates, a comparative anatomist can speak with authority; but the step has perhaps been taken in the right direction by relegating this curious creature to a subordinal rank. The older subordinal name Anthropoidea is replaced by Pithecoidea by Osman Hill, probably because it is a more expressive term. In the outline classification on page 25, we note that contrary to the latest classification proposed by Simpson, the families of Pithecoidea have not been grouped into any category between the suborder and the family. This would seem to make the classification simpler no doubt, but it is hoped that the second volume, which will deal with this suborder, will clarify the procedure adopted here.

The account of Strepsirhini forms the bulk of the book. It is divided into two suborders, Lorisioidea and Lemuroidea. Two families are included under the former, and eight under the latter. Each of them has been critically dealt with under such items as historical, external characters, skeletal system, dentition, articulatory system, myology, splanchnology, angiology, neurology, reproduction, development, behaviour, taxonomy, distribution, etc.

The treatment of the facts of morphology, appears to be rather liberal, but this seems inevitable in many cases owing to paucity of information on topics other than morphology. In the author's attempt to supply a detailed description of each group, some unavoidable repetition of facts have crept in. Diagnostic keys have been provided up to species, but they have been left out for subspecies; nevertheless, a perusal of the descriptions of subspecies makes it at once evident that the author has admirably brought out their respective

distinguishing characters. A key to the subspecies would have lent an additional feature to the book, but its absence has by no means minimized its usefulness. A further commendable feature of the book is the distribution maps.

An extensive and well-selected list of references, without titles of papers, marks another feature. This procedure was probably adopted by the author in order to accommodate the matter within a few pages. In the index the subspecies are arranged under the species, and the species under the genera, which are arranged alphabetically. This has made the consultation of the index somewhat more time-consuming. The traditional method of arranging all scientific names in a single alphabetic order would have facilitated the use of the index.

A few minor slips are casually noticed; for example, in giving Simpson's outline classification on page 24, the superfamily Daubentoniidea has been overlooked; on page 318 the correct date for Schwarz's reference should be 1931; the length of the skull of *Lemur catta* as stated on page 391 appears to be an error; and the colour of the back of the head of *Propithecus d. diadema* does not appear to have been correctly given (p. 519).

We can confidently say that it is a book which will satisfy all who are interested, and that by the publication of this book Osman Hill sets an example to be emulated by all those who are desirous of undertaking systematic reviews.

H. KHAJURIA.
B. BISWAS.

The Mind and the Eye. (*A Study of the Biologist's Standpoint.*) By Agnes Arber. (Cambridge University Press), 1954. Pp. 146. Price 16 sh.

Mrs. Arber is a distinguished botanist and the author of that classic, *The Natural Philosophy of the Plant Form*. But here she turns from the usual preoccupations of a specialist, to face the broader issues which it is given only to some to ask themselves. As stated in the preface, the author found her mind "dwelling more and more upon the nature of scientific thought, and its relation to other intellectual activities. Such ponderings have led me gradually to realize how little I, as a biologist, could actually justify, or even, indeed, understand, the nature of the basic assumptions and modes of argument which, in accordance with scientific tradition, I was taking simply as 'given'".

These reflections are embodied in the course of ten essays, of which the first five are concerned with the nature of biological research and the rest with the basis of biological thinking. The essays reveal much philosophical erudition, as evidenced by the many references; also the author has taken great pains to explore the borderland between science and philosophy. Even specialists with no inclination to philosophy will find much practical wisdom in the two chapters on the use of analogy and the many imperfections of the written word for a description of the objective reality that concerns the scientist.

Some like the reviewer might have been led to expect a great deal more from a book with such a title, but the preface vindicates the author from any criticism on this score. As a more generalised analysis of the biologist's approach to his own subject and to philosophy, the volume is highly commendable: an excellent guide book, one is inclined to say, to any scientist who feels like making excursions occasionally into the realms of philosophy, for greater freedom and enjoyment.

Elsevier's Encyclopaedia of Organic Chemistry.

Edited by F. Radt. Series III. Carbocyclic condensed compounds. Vol. 12 B. Naphthalene. A. Compounds containing one naphthalene nucleus. Naphthoic acids and their halogen, nitrogen and hydroxyl derivatives. (Elsevier Publishing Co.), 1953. Pp. 3965-4560. Price £ 16 to subscribers.

The seventh part of Vol. 12 B deals with the naphthoic acids, their hydro-derivatives, homologues, halogen, nitrogen and hydroxyl derivatives. Lactones and lactams are treated in conjunction with the hydroxy- and aminocarboxylic acids. The general excellence, comprehensiveness and dependability of the earlier volumes of Elsevier have been maintained. Methods of preparation of the more important compounds are given in such detail that they can be repeated without reference to the original literature. Elsevier is now to be found in the library of every institution handling organic chemistry in any of its aspects; and regular users of Elsevier look forward anxiously to the appearance of new volumes because they have found by experience that, if an Elsevier volume treats a group of compounds in which they are interested, hours of labour in hunting up literature will be saved. The gap between the date of publication of an Elsevier volume and of the material it records has been reduced to about four years. The policy, criticised by this

reviewer in reviewing earlier volumes, of omitting patent literature has now been abandoned.

The treatment of the naphthoic acids includes their physical properties, formation, preparation reactions and physiological properties. All the known derivatives are dealt with in detail. Hydroxynaphthoic acids and their derivatives, especially the technically important 2-hydroxy-3-naphthoic acid and its arylamides (Naphtol AS and its analogues), are treated very fully. No error or material omission was detected. Naturally occurring compounds receive particular attention, and there are excellent accounts of podophyllotoxin, picropodophyllin and related compounds, very recent literature being incorporated with the co-operation of Drs. Schrecker and Hartwell of the National Cancer Institute of the U.S.

K. V.

Metabolic Integrations. By P. G. Watson. (W. Heffer & Sons., Cambridge), 1954. Pp. 12. Price 12 sh. 6 d.

This booklet on metabolic integrations consists mainly of charts illustrating the various metabolic reactions, and is primarily intended to give a coherent picture of the various energy-releasing biochemical reactions. In twelve pages are given a master chart of Krebs tricarboxylic acid cycle, Krebs ornithine cycle, and cytochrome systems as well as nine other charts showing the breakdown of nucleotides and nucleic acids, anaerobic metabolism of glycogen, starch, sugars, fats, amino acids and nitrogenous excretory products. While the main references are given at the end on the inside back cover, these charts by themselves should prove very useful to all students of biochemistry and physiology as summaries of various biochemical processes, and the author is to be congratulated on bringing out such a commendable publication.

P. S. SARMA.

Imidazole and Its Derivatives, Part I. By Klaus Hoffmann. (Interscience Publishers, Inc.), 1953. Pp. vii + 362. Price \$ 8.00.

The volume under review is the sixth in the series of monographs edited by Dr. Weissberger on the chemistry of heterocyclic compounds and deals with imidazole and its derivatives. In Section 1 of the volume an accurate and comprehensive account of the chemistry of imidazole and its derivatives such as alkyl and aryl imidazoles, oxo- and hydroxyimidazoles, halogeno-, nitro-, amino- and arylazoimidazoles, and imidazole-carboxylic and sulphonic

acids is given. The chemistry of imidazolines, imidazolidines and benzimidazoles is also dealt with at great length. The discussions on the individual classes of imidazole derivatives and their physical properties and chemical reactions furnish excellent and stimulating reading. The book would be well worth study, not only by those interested in imidazole derivatives, but by all chemists engaged in the study of heterocyclic compounds.

In Section 2 of the book, a list of imidazole derivatives has been presented, the literature having been surveyed upto the end of 1950. A bibliography with over 700 references is appended to this list. The book is a most useful publication and should find a place in all libraries attached to institutions engaged in teaching of organic chemistry or research in this field.

T. R. G.

A Historical Survey of Petrology. By F. Y. Loewinson-Lessing. Translated from the Russian by S. I. Tomkeieff. (Oliver & Boyd, Edinburgh and London), 1954. Pp. 111. Price 12 sh. 6 d.

The volume under review is an excellent source-book for the history of petrography and petrogenesis. The translator does not regard this as a verbatim English translation of Loewinson-Lessing's book in Russian, but states that it is a free translation, with curtailments, amplifications and additions. The translation has thus enriched and made the original more up-to-date. The book is written in six sections, five of which are devoted to the different points of approach to the subject of petrology, namely, the geological, the petrographic, the chemical, the experimental and the synthetic.

The history of petrology is divided into the pre-microscopic and the microscopic periods, the dividing line being probably the year 1870. The microscopic period is again subdivided into two stages, the first one being distinguished by intensive descriptive petrography (1870-90), and the second from 1890 onwards, by chemical petrology. In his geological approach, Loewinson-Lessing gives a historical account of the various petrologists who have studied rocks with reference to distribution in space and time. One of his distinguishing remarks is, "Another well-rooted opinion that all granites are ancient rocks, and in fact mainly of the Pre-Cambrian age, has been shattered by the discovery of granites of Palaeozoic, Mesozoic and Kainozoic age".

The book recalls everything we know of rocks from the earliest days of the French petrology

gists like Cordier and Brougniart, to the present day of American experimentation in the Geophysical Laboratory, New York. No student of petrology should miss this book from his reference-collection.

P. R. J.

History of Indian Pharmacy, Vol. I. Second Edition. By G. P. Srivastava. (Pindars, Ltd., Calcutta-20), 1954. Pp. 276. Price Rs. 12-8-0.

This book which claims to be a history of ancient and mediæval pharmacy in our country, was originally published in parts as series of articles in the *Indian Pharmacist*. A second volume which is promised by the author, will deal with modern Indian pharmacy.

The volume consists of ten chapters dealing with the origin of medicine or the healing art in India in the dim, hoary, legendary past—the beginnings shrouded in mythology and theology and nothing more authentic up to the middle ages of history.

The book is obviously the result of much labour, tinged with sentiments of national pride and perhaps idealism as well. Indian books that claim to belong to pre-Christian era, have often in them matters to provoke awe and admiration, but unfortunately the dates of these writings remain unproved. Even if they are proved to belong to a later era, such as early Christian period, there is still considerable material in them to command admiration and for careful observation, collection and experimenting.

This book therefore is one more 'Archæological find' to enhance the prestige of ancient India and this time in the field of pharmacy. The author deserves praise for his labours.

V. ISWARIAH.

Handbook of Cosmetic Materials. (Their Properties, Uses and Toxic and Dermatologic Actions.) (With a chapter on The Skin by Howard W. Haggard.) By Leon A. Greenberg and David Lester. (Interscience Publishers, Inc.), 1954. Pp. xii + 455. Price not given.

A continued search by the chemist for cosmetic aids for specific purposes has resulted in the use of several hundred synthetic chemical compounds. Whether the compounds being used are new or old, the cosmetic manufacturer must have a knowledge of their toxic and dermatologic properties. This awareness led the (U.S.) Toilet Goods Association "to request the members of the cosmetic industry to furnish lists of ingredients important to them with a view to the development of a basic reference work".

The present Handbook lists nearly 1,000 materials—those that are more commonly used by the cosmetic manufacturers. The staff of the Yale University Laboratory of Applied Physiology compiled all the available information on each compound or material included in the list. This information has been arranged under five headings: Formula (including collateral names), properties, uses, toxic action and dermatologic action. An important feature of the Handbook is the extensive bibliography of the literature on the toxic and dermatologic actions of the compounds. This would be of great assistance to both the cosmetic manufacturer and the research worker in that field.

It has been stated in the Foreword that the work of reviews and compilation took about four years, which indicates the care and effort that must have been bestowed upon it. The reviewer is not unmindful of these when the following comments are made: (1) There is lack of uniformity in giving the occurrence or the method of obtaining and the constituents of a material. These are sometimes given under 'Formula' and sometimes under 'Properties'. (2) Component fatty acids of some of the fatty oils have been incorrectly given, e.g., oils of palm and linseed. Oil of cod liver is stated to contain butyl alcohol esters. Oil of peanut is stated to contain hypogæic acid—an obsolete term. (3) No uniformity has been observed in giving the constituents of essential and fixed oils. For some, percentage composition is given; for others, only the components are mentioned or no mention of components is made at all (e.g., oils of palmarosa and sesame). (4) Melting points of cocoa butter and of lauric, myristic and palmitic acids are incorrectly given. (5) The usefulness of such a Handbook would be greatly increased if an 'Index of Uses' were to be incorporated.

The chapter on "The Skin" forms an appropriate part of the Handbook. Members of the cosmetic and allied industries as well as chemists, physicians and dermatologists would find the Handbook highly useful. J. G. KANE.

Optical Image Evaluation. (Proceedings of the Symposium held October 18-20, 1951, NBS Circular 526.) (Order from Govt. Printing Office, Washington 25, D.C.), 1951. Pp. 289. Price \$2.25.

The National Bureau of Standards, U.S.A., has been active in the field of optical image evaluation for many years. In the field of applied optics it has been usual to evaluate optical design by taking measurements of the system's geometric aberrations. This practice

is justified when the aberrations are so large that diffraction plays but a small part in determining the quality of imagery. Now, however, better optical systems are being produced. Automatic computers make it possible to completely test a design by computation. The interferometer enables the wave front emergent from an optical system to be completely mapped. Also, integrating devices can be used to readily and completely determine the diffraction effects. Accordingly it is now possible to evaluate an optical image forming system in terms of physical optics either when it has only progressed to the design stage or after a prototype is available.

As a consequence of these new developments it seemed desirable to re-examine the older methods of image evaluation as well as the newer procedures in order to place image evaluation upon a more sound engineering basis. For this purpose a symposium was held in which scientists from all parts of the world participated. The full papers of this symposium are presented in this book including the discussions.

Books Received

- Wool—Its Chemistry and Physics.* By P. Alexander and R. F. Hudson. (Chapman & Hall), 1954. Pp. viii + 404. Price 45 sh.
- Subminiaturization Techniques for Low-Frequency Receivers.* (NBS Circular 545), 1954. Pp. iv + 64. Price 50 cents.
- Text-Book of Metallurgy.* By A. R. Bailey. (Macmillan & Co.), 1954. Pp. viii + 560. Price 30 sh.

Stainless Iron and Steel, Vol. 2. Third Edition. Revised. (*Microstructure and Constitution*.) By J. H. G. Monypenny. (Chapman & Hall), 1954. Pp. xii + 830. Price 55 sh.

Essays on the Social History of Science, Vol. 3. Edited by S. Lilley Cennaurus. (Ejnar Munksgaard, Copenhagen), 1953. Pp. 182. Price not given.

Annual Review of Biochemistry, Vol. 23. Edited by J. Murray Luck, Hubert S. Loring and Gordon Mackinney. (Annual Reviews, Inc.), 1954. Pp. ix + 636. Price \$7.00.

Technical Report of the Scientific Advisory Board for the Year 1953. (Indian Council of Medical Research), 1954. Pp. xiii + 449. Price Re. 1.

The Physical Chemistry of Dyeing. By Thomas Vickerstaff. (Macmillan & Co.), 1954. Pp. viii + 514. Price 42 sh.

Ion Transport Across Membranes. Edited by H. T. Clarke and D. Nachmansohn. (Academic Press, Inc.), 1954. Pp. xi + 298. Price \$7.50.

Hydraulic Research in the United States. Edited by H. K. Middleton. (NBS, Washington 25, D.C.), 1954. Pp. xii + 193. Price \$1.25.

Discovery Reports, Vol. XXVI, Nos. 1-8. Issued by the National Institute of Oceanography. (Cambridge University Press), 1954. Pp. vi + 354. Price 99 sh.

Micro-Element Nutrition of Plants. By K. N. Lal and M. S. Subba Rao. (Banaras Hindu University Press, Banaras 5), 1954. Pp. viii + 246. Price Rs. 20.

PROTEINS IN HEALTH, DISEASE AND INDUSTRY

A SYMPOSIUM on the above subject was held in Bombay on 6th and 7th August 1954, under the auspices of the National Institute of Sciences of India, when several papers among the forty-four received, were read and discussed. Many of them stressed the need for the proper utilization of waste proteins like those from shark fish residues, and the preparation of protein hydrolysates from pulse proteins, fibrin and the like. Interesting discussion took place in regard to the degree of hydrolysis of proteins during acid and enzymic digestion and the destruction during hydrolysis of some essential amino acids. The use of formic acid along with the hydrochloric acid for a quick and efficient method of hydrolysis of tissue proteins was also discussed. The nutritive value of different proteins by such methods as bio-

logical value determination using rats and by the maintenance of liver cytoplasm was also reported. Other interesting reports were the remarkable growth-stimulating effect observed in growing heifers when small amounts of iodinated casein were added to their daily feed, and the study of the different factors such as buffer, temperature and catalyst in the iodination of different proteins. Papers relating to bacterial proteins and their prophylactic use, the mechanism of specific dynamic action of proteins, the reactivity of thiol groups in proteins and histamine-like substances in protein hydrolysates were also interesting, as well as the one relating to preservation of proteins particularly the processing of meat from fish of the carp variety.

P. S. SARMA.

SCIENCE NOTES AND NEWS

Insecticidal Resin

An effective method of insect control used in British cargo ships involves spraying infested surfaces with a lacquer containing the insecticide dieldrin. Such a lacquer is Ripolac. This sets in about 30 minutes giving a hard glassy surface with an insecticidal activity that is claimed to last for over 2 years. Microscopic crystals of the insecticide form on the hardened surface of the lacquer and stick to the feet of insects as they alight on it. The insecticide is so powerful (in some cases 200 times as toxic as D.D.T.) that even a few crystals picked up will eventually kill the insect. This means that momentary contact only is necessary. The lacquered surface can be washed repeatedly with detergent without losing insecticidal activity. Economical use of lacquer is appreciably assisted by a knowledge of the life-history of the pest. For example, cockroaches like dark, sheltered niches and for their destruction the lacquer should be applied to corners, cracks and the under-surfaces of furniture.

Steroids for Chromatography

Through the co-operation between a number of fine chemical companies and university laboratories in the United States, steroid preparations for use as reference standards for paper chromatographic techniques are now available. This service has been undertaken by the United States Pharmacopeial Convention, 46, Park Avenue, New York-16, which has announced the issue of the first set of twenty-four steroids of importance for identification purposes. Many of these have hitherto been unobtainable from commercial sources. The price of the complete set is \$60; but the individual steroids can be obtained for \$3 each. They are diluted with talc in the proportion of 1:100, and from this mixture the steroid can be readily extracted with an appropriate solvent. Most of the steroids contain trace amounts of contaminants which will not normally interfere in chromatographic procedures. Physical data of the steroids are set out in an accompanying leaflet, which also provides information concerning the programme of the United States Pharmacopeia Service. It is proposed to issue further sets of steroids, and in due course a total of fifty-two steroid standards will be available to all parts of the world.—(By courtesy of 'Nature').

Fresh-water from the Sea

A device for extracting fresh-water from sea-water by using the same purification principle as body tissue has been developed by Mr. Gerald Hassler, an engineer in the University of California.

Mr. Hassler's process involves the selective action of an osmotic oil membrane, the principle by which body organs and individual cells separate fluid constituents. Osmotic membranes have been proposed before in connection with sea-water distillation. However, previous membranes have been like sieves, with tiny holes which allow small molecules to pass through while rejecting larger ones.

The Hassler membrane is an extremely thin layer of oil supported by capillary action. It has no holes as such, but water molecules can diffuse through it while other molecules are blocked. Mr. Hassler believes he can ultimately produce "a cubic yard" of oil membranes capable of producing 2,000 gallons of fresh-water per day. The unit would cost about \$1,000 and last for 20 years.

Journal of the University Geological Society, Nagpur

The inaugural number of the Journal which is being sponsored by the University Department of Geology, Nagpur, contains the following titles: 'A Tourmaline Pegmatite from Koradih, Central Provinces', by Sripadarao Kilpady; 'A Giant Pelecypod from the Cretaceous Rocks of Trichinopoly', by Sripadarao Kilpady; 'A Note on a Green Calcite from the Deccan Traps', by Sripadarao Kilpady and P. G. Adyalkar; 'Fossil Algae as Criteria of Palaeo-Ecological Conditions', by Sripadarao Kilpady; 'Dumortierite from Garrah, Balaghat District (M.P.)', by Sripadarao Kilpady and A. S. Dave; 'Newer Developments in the Search for Hidden Mineral Deposits' by Alan M. Bateman. The Journal conforms to the standards expected of one devoted to the publication of pure research. We extend to it our heartiest good wishes.

Indian Association for the Cultivation of Science Report for 1953-54

The Annual General Meeting of the Indian Association for the Cultivation of Science was held on Friday, July 30, 1954. Prof. P. Ray, Acting Director, in presenting the Annual

Report stated that the research departments, the library, the workshop and the administrative office continued to function actively for the third year in the new research laboratory building at Jadavpur.

During the year under review, the Association had under operation four research schemes of the Council of Scientific and Industrial Research of the Government of India. A symposium on high polymers including rubber, resins and plastics and fibre was organized by the Department of Physical Chemistry of the Association.

The following officers were elected for the current year: *President*: Hon'ble Sri. C. R. Biswas; *Vice-Presidents*: Prof. S. K. Mitra, Dr. K. S. Krishnan; *Director*: Prof. M. N. Saha.

World Census of Agriculture

The United Nations Food and Agriculture Organization hopes to complete, by the end of 1954, the first volume of a world census of agriculture. The work, which is the third such study ever to be undertaken, will cover agricultural statistics for 63.3 per cent. of the land surface of the globe and covers territories inhabited by 67.6 per cent. of the world's population.

The census will be published in three volumes: the first will summarize statistical methods used for the census; the second will tabulate the data for each country; and the third will make a comparison of each country's statistics and analyse, on a regional or worldwide basis, the principal elements such as utilization of land, tenure, agricultural workers, crops and stock-breeding.

The publication of the second and third volumes in 1955 and 1956 respectively will complete ten years' preparation, collation and analysis of facts supplied by over a hundred countries and territories.—UNESCO.

Conference on Human Problems in Industry

A Commonwealth and Empire Conference on human problems in industry is to be held in Britain (probably at Oxford) during July 1956. The purpose of the Conference will be to bring together representatives from the Commonwealth and Empire who would pool their knowledge and experience of the human problems of industry in their own countries. It is intended that the age of the delegates should normally be between twenty-five and forty. The Conference will deal with the human factors in industrialization as a whole: on one hand

the personal factors of the health, satisfaction, effectiveness and well-being of those working in industry; on the other, the social problems arising from the effects of industrialization on the lives of individuals, their families and communities. Further particulars can be obtained from the Industrial Welfare Society, 48, Bryanston Square, London, W.1.

Electronics Course at Harwell

Applications are invited by the Atomic Energy Research Establishment, Harwell, from physicists and electronic engineers holding a Degree or equivalent qualification, who wish to attend the ninth electronics course. The course covers the design, use and maintenance of electronic instruments used in nuclear physics, radiochemistry, and in work with radioisotopes. It is to be held at the Isotope School, Harwell, during November 1-5. Attendance at the course is limited to 12 students. The syllabus will include lectures and practical work concerned with counters, D.C. and pulse amplifiers, coincidence units, scalars and ratemeters. The lecturers and demonstrators will be specialists from the Atomic Energy Research Establishment. The fee for the course is 12 guineas, and living accommodation can be arranged locally at a charge of 5 guineas approximately. Further information can be obtained from the Electronics Division, A.E.R.E., Harwell, Didcot, Berks. Application forms must be returned by October 15.

Burmah-Shell Scholarships

The Council of Scientific and Industrial Research have awarded the Burmah-Shell and Assam Oil Co. Scholarships tenable in Commonwealth countries to the following for scientific research and technical training in the subjects noted against their names:

Burmah-Shell Scholarships.—R. Nagarajan (New Delhi): Highway Engineering; Krishna Chandra Pant (Lucknow): Electro-Chemistry; and Nareshchandra Majumdar (New Delhi): Power Engineering.

Assam Oil Company.—B. V. Ranganatham (Madras): Avoidance of Foundation Failure; Rajinder Paul Khera (Bhavnagar): Corrosion and Wear; R. Narayanaswami (Bombay): Prestressed Concrete; P. S. Ram Mohan Rao (New Delhi): Structural Designs; A. Kameswara Rao (New Delhi): Aviation Engineering; K. B. Narain (Delhi): Designs and Construction of Transformers Rotary Convertors, Electric Generators, etc.; Daleep Singh Deorha (Meerut): Chemo-Therapy.

UNESCO Travel Coupons

In March 1954, UNESCO launched its Travel Coupon Scheme, which enables students, teachers and research workers to obtain foreign currency to study abroad. They constitute the latest addition to the series of UNESCO Coupons which overcome cultural barriers. In 1948, the Book Coupon Scheme was started with only 5 countries and a 'hard-currency' backing of \$100,000. Now 33 countries use UNESCO Coupons and over 5 million dollars' worth of coupons have been put into circulation.

Full details of the UNESCO Travel Coupon Scheme may be obtained from the UNESCO Coupon Office, 19, Avenue Kleber, Paris 16^e, France.

Heavy Water Reactor at Harwell

Britain's first heavy water reactor, or atomic pile, which has been built at the Atomic Energy Research Establishment, Harwell, is a low-powered thermal neutron research reactor. The heavy water moderator is contained in a tank surrounded by a graphite neutron reflector, outside which is a concrete radiation shield. The reactor fuel is submerged in the heavy water. The type of fuel as well as its arrangement in the tank can be changed quickly so that what is, in effect, a different design of reactor can be built up in a matter of a few days.

The reactor will be operated only at very low power so that its structure does not become sufficiently radioactive to prevent the necessary handling. One of the first functions of the reactor will be to carry out experimental work for E443, the new and more powerful heavy water reactor which is being built at Harwell to provide the high neutron flux essential for some research purposes. E443 will be a small, highly specialized unit for the more immediate testing of the materials used in nuclear reactors. This becomes more necessary as reactors of more advanced design are being considered. With the existing facilities at Harwell tests of materials may take up to a year. With E443 a maximum of about 10 days should be enough.

Like the American Materials Testing Reactor, built at Arco Idaho in 1952, it will use uranium, but highly enriched with U235 from the gaseous-diffusion plant at Capenhurst. This makes for a smaller and cheaper reactor. Size is also reduced by the use of heavy water as a moderator. The reactor has been quaintly

named the *Dimple*, which is short for 'Deuterium Moderated Pile, Low Energy'.

Report on ACTH and Cortisone

The British Medical Research Council Report, 1952-53, says that research into the use of the drugs cortisone and ACTH in the treatment of rheumatic diseases has enabled a more balanced view of the value of these hormones to emerge. The danger of ACTH and cortisone therapy would seem to be far from negligible.

Above a certain dosage side-effects, such as coarsening of appearance, increase in weight, hairiness, and so on, might appear. Experience tended to show that the minimum doses required to maintain freedom from joint symptoms were commonly at or above the level which produced such side-effects. There were also more serious dangers. High blood pressure, heart failure, diabetes mellitus, activation of latent tuberculosis, perforation of peptic ulcers and mental disturbances had all been reported as occasional complications. To some extent these could be prevented by excluding from the treatment patients who showed even the slightest evidence of any of these conditions. The report adds that therapy with ACTH and cortisone should never be undertaken lightly, and concludes that it is too early to determine the part that hormones will ultimately play in the treatment of rheumatoid arthritis.

Geological, Mining and Metallurgical Society of India

At the Thirtieth Annual General Meeting of the Society held recently, the following officers for 1954-55 were elected:—*President*: Mr. M. K. Ray, Achipur; *Vice-Presidents*: Mr. J. N. Mukherjee, Calcutta; Mr. W. B. Meire, Dhanbad; *Joint-Secretaries*: Prof. N. N. Chatterjee, Calcutta; Prof. N. L. Sharma, Dhanbad; *Members of the Council*: Mr. B. Bhargavan, Sambalpur; Mr. D. K. Chakravarty, Benares; Mr. P. K. Chatterjee, Calcutta; Mr. Jayantilal Ajha, Calcutta; Mr. N. N. Kapur, Jharia; Prof. S. R. Narayana Rao, Lucknow; Dr. M. S. Patel, Bombay; Mr. M. G. Rawell, Nagpur.

Burmah-Shell Loughborough Scholarships for 1954

The Burmah-Shell Loughborough Scholarships for 1954 have been awarded to Devendra Sahai and Sundarshan Kumar Maini, both of the Banaras Hindu University.